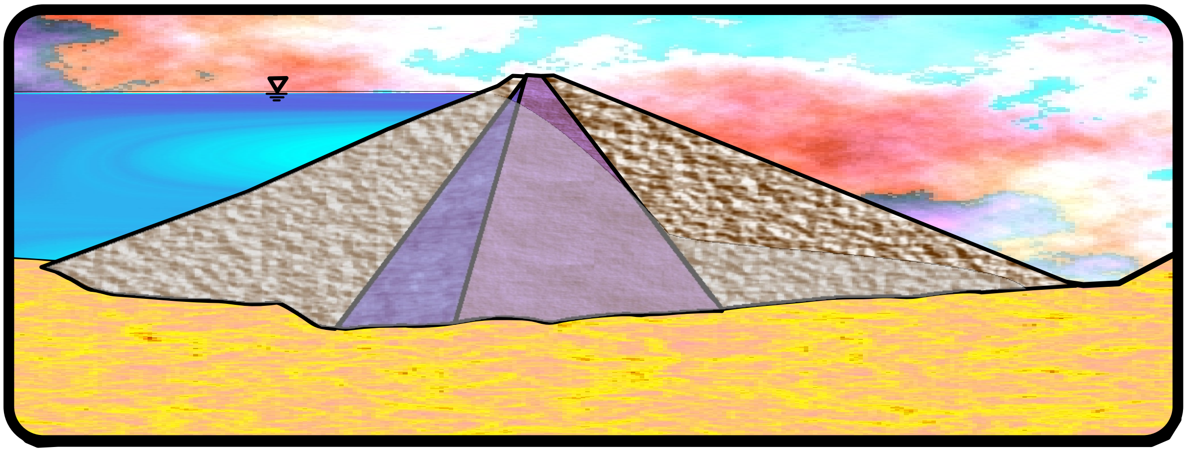
October 2004

SECOND INTERIM
SURVEILLANCE REPORT
Nov 2002 - Oct 2004
LEROY ANDERSON DAM No. 72-9
Santa Clara County



WATER – OUR MISSION FOR 75 YEARS
Santa Clara Valley
Water District℠

October 25, 2004

Mr. David A. Gutierrez, Acting Chief
Division of Safety of Dams
Department of Water Resources
1416 Ninth Street
P.O. Box 942836
Sacramento, CA 94236-0001

Subject: Leroy Anderson Dam, No. 72-9, Santa Clara County
Nov. 2002 - Oct. 2004, Second Interim Surveillance Report

Dear Mr. Gutierrez:

Please find enclosed two copies of our summary report for Leroy Anderson Dam covering the period from November 2002 to October 2004. This report includes an analysis of data from 2 pneumatic piezometers, 2 spillway underdrain seepage weirs, 15 dam crest survey monuments, and 3 spillway training wall survey monuments. Interpretation of the surveillance data from Anderson dam and the District's field observations confirm acceptable performance of the dam and spillway for the period of this report. Piezometer and weir data will continue to be measured monthly, and crest monuments will be surveyed annually.

On May 29, 2003, the dam was inspected by various District staff, including the authors of this report, in addition to Mr. Andy Mangney, engineer with DSOD. On November 20, 2003, the dam was inspected by District staff, including the authors, in addition to Mr. Andy Mangney and Mr. Param Dhillon. Based on these field observations, and our interpretation of the instrumentation data presented herein, Anderson Dam appears to be performing satisfactorily.

If you have any questions or comments regarding our surveillance program in general, or this report in particular, please contact Mr. Richard L. Volpe, Senior Engineer, Dam Safety Group, Infrastructure Planning Unit, (408) 265-2607, extension 2602.

Sincerely,

Original signed by:

David E. Hook, P.E.
Engineering Unit Manager
Water Utility Engineering Unit

Enclosures

cc: w/encl. R. Yep, J. Aguilera, D. Gilleland, D. Hook , R.L. Volpe, J. Nelson, M. Mooers,
library (4 copies), Records Management
cc: S. Oblonsky

SURVEILLANCE REPORT
Nov 2002 - Oct 2004
LEROY ANDERSON DAM No. 72-9
Santa Clara County

date of photo 1/29/03

Prepared for:

State of California
Department of Water Resources
Division of Safety of Dams
P.O. Box 942836
Sacramento, CA 95236

Prepared by:

Santa Clara Valley Water District
5750 Almaden Expressway
San Jose, CA 95118

October 2004

SECOND INTERIM
SURVEILLANCE REPORT
Nov 2002 - Oct 2004
LEROY ANDERSON DAM No. 72-9
Santa Clara County

The interpretation of the instrumentation and other relevant data presented in this report has involved the application of certain graphical and statistical interpretive techniques common to the geosciences and earth dam engineering professions. The conclusions presented in this report were developed upon evaluating the performance of all instruments and other pertinent data during the specified period, and represent the professional judgment of its authors. This report was submitted on October 25, 2004.

Report prepared by:

Original signed by:

____
James L. Nelson, C.E.G.
Associate Engineering Geologist
Infrastructure Planning Unit

Original signed by:

____
Michael Mooers, P.E.
Associate Engineer
Infrastructure Planning Unit

Quality Control/Quality Assurance

This report has been reviewed and approved for publication by the undersigned professional engineers. We attest and confirm that the report was prepared by the individuals who signed the report under our immediate direction and supervision and that the conclusions and recommendations presented herein are reasonable and supported by District management.

Reviewed and approved by:

Original signed by:

Richard L. Volpe, P.E., G.E.
Senior Engineer
Infrastructure Planning Unit

Original signed by:

David E. Hook, P.E.
Engineering Unit Manager
Infrastructure Planning Unit

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Appendix B - Central California Earthquake, December 22, 2003 memorandum from R. L. Volpe to D. Hook.

ATTACHED CD:

Raw Survey Data

1.0 INTRODUCTION

This Second Interim Report contains surveillance data collected from Anderson Dam, No. 72-9, from November 2002 through October 2004. The focus of this Interim Report is to review the data for overall accuracy and to make assessments of general data trends. If any significant geotechnical or operational events have occurred (i.e., earthquakes, sustained elevated reservoir levels, significant operational or maintenance changes, or dam instrumentation/monitoring changes), these are addressed to the appropriate level in this report.

During the time period covered by this report, the Santa Clara Valley Water District (District) monitored 2 pneumatic piezometers in the dam, 2 spillway underdrain seepage weirs, 16 dam crest survey monuments, and 3 spillway training wall survey monuments. An observation well designated as OW-1 was installed in August 2003 at the downstream toe of the dam as shown on Figures 1 and 2. Amemo summarizing drilling and well construction details is included in Appendix A. All new data covered in this report is presented in tabular form, and plotted to facilitate review.

The physical location of instruments discussed herein are shown in plan in Figure 1, and in section on Figure 2.

Tables 1 through 3 summarize recent piezometer, weir, and surface monument survey data, respectively. All surveillance data are also shown graphically on Figures 3 through 11, and discussed later in the report.

For the period of this report, data were collected monthly for piezometers and weirs. Crest monuments were surveyed at the times indicated (typically every year to a year and a half).

All elevation data have been adjusted for the current datum used by the District which is the North American Vertical Datum (NAVD) 1988, which is 2.80 feet higher than the old datum (NGVD) at this location.

Reported rainfall is from District Rain Gauge No. 41-2073, located a few hundred feet southeast of the left abutment of Leroy Anderson Dam.

2.0 PIEZOMETER DATA

Figure 3 is a plot of the piezometric surface elevations from January 1993 through October 2004. The recent data, from November 2002 to October 2004, obtained since our last report, is shown as a shaded region on Figure 3.

Reservoir elevations and monthly rainfall data are presented for reference. Although not shown as tabular data, we include cumulative rainfall from July to June each year on piezometer and weir plots (Figures 3 and 4).

Reservoir levels have remained well below the crest of the spillway weir (at least 25 feet) since ~2001 for two different reasons: 1) due to below normal rainfall in the Coyote Creek watershed; and

2) in order to accommodate construction of a new boat ramp by Santa Clara County Parks and Recreation. The boat ramp construction was recently completed (2003/2004).

Overall, the data indicates that fluctuations in piezometric levels generally correspond to fluctuations in reservoir level, and tend to fall within the typical ranges of historical levels. Within the past two years, however, data from pneumatic piezometer PPA-2 has indicated two apparent increases in pore pressure response (designated as spike1 and spike 2 in the piezometric surface elevation (PSE)) even though reservoir levels have been, and continue to stay, well below historic values. Spike 1 occurred between December 2002 and February 2003 and spike 2 occurred between April 2004 and October 2004 (Table 1 and Figure 3). Spike 1 is essentially a single PSE peak of ~el. 506.9 ft, while spike 2 is evident as gradual increasing PSE from May 2004 (~el. 496.5 ft) to September 2004 (~el. 519 ft). Spike 1 generally corresponds to an increase in reservoir level of about 17 feet (10/16/02 through 1/16/03), while spike 2 occurred during decreasing reservoir levels. Neither of the spikes follow the previous ~10-year trend in historic PSE for PPA-2, which have been relatively consistent in the range of ~el. 490 ft to ~el. 500 ft. This trend has occurred even during significant increases in reservoir levels to the spillway crest through at least 7 consecutive seasons (1993 through 2000) when the reservoir filled and spilled. Our research into the abnormality of spike 2 indicated that a new technician has recently been collecting field piezometer data at Anderson Dam. To evaluate whether experience with taking field pneumatic piezometer readings could be a factor, we recently checked PPA-2 by having an experienced technician collect data on October 18, 2004. The latest PSE reading of ~el. 496 ft is consistent with historic trends of PPA-2 (see Figure 3). We have tentatively concluded that spike 2, and likely spike 1, may have been due to operational inexperience. For the November 2004 reading we have asked that the experienced technician visit the site with the new technician to review the field procedures being used for the pneumatic piezometers. We will continue to monitor this issue and keep DSOD appraised.

At the request of the Federal Energy Regulatory Commission (FERC), the District installed a monitoring well designated as OW-1 on August 5, 2003 at the downstream toe of Anderson Dam as shown in Figure 1 in order to measure and observe groundwater conditions in the area. In September 2003 the District began collecting piezometer level data from newly installed OW-1. Consequently, as shown in Table 1 and on Figure 3, about 1 year of data points have been collected. As shown in Table 1 and Figure 3 monitoring of OW-1 since September 2003 indicates minimal variation of the piezometric level which is at about elev. 406. As noted earlier, since 2001 Anderson reservoir levels have been consistently below normal operating range. It is possible OW-1 will show higher responses when reservoir levels return to normal historic elevations.

3.0 SPILLWAY UNDERDRAIN WEIR DATA

Figure 4 is a plot of the previously measured flow from the two spillway underdrain weirs from May 1993 through December 1998, and more recently measured spillway weir discharge data, from April 2000 to October 2004. The recent data, from November 2002 to October 2004 obtained since our last report, is shown as a shaded region on Figure 4. Reservoir elevations and monthly rainfall data are presented for reference.

Weir 1 measures underdrain seepage captured from beneath the original spillway (right side looking downstream); it should be pointed out, however, that discharge readings from Weir 1 could be nominally low due to a loose flange where the collector pipe to the weir connects to the end of the spillway underdrain pipe. We have submitted a work request to maintenance to repair the flange.

Weir 2 measures underdrain seepage captured from beneath the widened spillway (left side; installed during1988 construction).

The underdrain seepage collection system was installed to capture seepage from groundwater springs that were present in this area during construction of the spillway as well as seepage occurring from the reservoir. Underdrain seepage has subsequently fluctuated with higher reservoir levels (typically above elev. 600), with relatively high flows noted above elev. 615.

Since the time of our last report, the weir data indicates that underdrain discharge rates have remained low to negligible while the reservoir level has gradually increased from a low of about elev. 567' in December 2002 to a high of about elev. 593' in March 2004. Total underdrain flows ranged from lows of 0.45 gallons per minute (gpm) at various times to a high of 22 gpm in April 2004. Although flows are beginning to increase, they are currently significantly lower than the historical response at the 593 reservoir level.

4.0 SURVEY DATA

Modifications to Anderson Dam in 1988 included raising the dam crest 4 to 7 feet and widening of the spillway to accommodate new PMF requirements. Consequently, new monuments were installed in 1988 along the crest and at the right and left abutments. Unlike other District dams, the locations of the survey monuments at Anderson Dam alternate from the upstream to downstream side of the crest.

Before 1988 and the introduction of GPS surveys with the resulting data provided in the form of coordinates (Northings and Eastings), previous transverse data consisted of offset displacements either upstream or downstream relative to the monument line established soon after the dam was constructed. To conform to the format of surveillance reports for other District dams, we provide transverse monument data. These data are calculated from the coordinate data using trigonometric relationships assuming stable reference points away from the dam at the right and left abutments. It should be noted that transverse displacement is not applicable to the training wall monuments because they are not aligned along a single line-of-sight.

As discussed below in more detail, to further simplify our annual interim surveillance reports, we have made a significant change to the way yearly survey data are presented in tables and data plots. In addition, beginning with this report, we are providing DSOD with an electronic copy of raw survey data consisting of monument Northings, Eastings, and Elevations from 1988 to 2003 on a CD as an attachment.

Beginning with this report we developed a method of calculating transverse displacements in the immediate vicinity of the dam (hereafter termed “local”). Vector plots based on survey control points at moderate distances (~50 feet to 100 feet) from the dam included in previous surveillance reports appeared to be showing movements in previous reports that we could not readily account for, but that did not appear to indicate unsafe dam conditions. We decided to attempt to eliminate regional affects (whether due to local or regional tectonics, inherent instrument errors, or systematic data accumulation errors) and focus solely on monitoring possible deformations of the dam itself. Consequently, in our interim surveillance reports we will no longer provide tabular data and plots based on changes in Northings and Eastings data, or Vectors based on Northing and Easting data as we have done in the past. We will, however, include these items in our 5-year surveillance reports, especially the movements thought to reflect regional tectonic movements. Our focus for this and subsequent interim surveillance reports will be on calculated "local transverse displacements" and "local transverse displacement vector" plots, as discussed below in more detail.

Previously, transverse displacements were determined trigonometrically using assumed stable end points away from the dam itself, some located on bedrock slopes 50 to 100 feet from the end of the crest. These end survey data points are shown on Figure 1 as points #3 and #33 north and west of the dam, respectively, and points #1 and #32, southeast and southwest of the dam, respectively. It appears possible that minor survey errors could be introduced by surface creep of these monuments because they are located on steep rock slopes or because these control points are sighted over relatively long distances. In an attempt to eliminate these effects and focus only on local movements of the dam, we now determine "local transverse displacements" and plot "local transverse displacement vectors" using mon. #16 near the northwestern end (right abutment) and mon. #30 near the southeastern end (left abutment) of the dam as reference points. Local transverse deformations using these monuments are roughly perpendicular to the crest of the dam. Because mons. #16 and 30 are reference points; by definition they will not show any movement. Consequently, local transverse displacements of mons. #16 and #30 are reported as zero in Table 3-1.

It should be noted that for this report we specifically back-calculated all survey data to the new "local" transverse format collected since 1988, when new monuments were installed after the most recent dam raise. Consequently, for this report, the data plots of Figures 7 and 8, and local transverse data in Table 3-1, range from 1988 to the present.

4.1 Dam Crest and Abutment Monuments

The crest monuments generally alternate between the downstream edge and upstream edge of the crest. Data plots have been grouped as either "upstream (U/S) edge" or "downstream (D/S) edge". The location of the surface monuments are shown on Figure 1.

In past surveillance reports monuments, #16 and #31 were included in both the U/S and D/S groups because they are located on the right and left abutments, respectively, at the ends of the dam approximately along the projection of the centerline of the crest. However, it should be noted that mon #31 at the left end of the dam and control mon. #1 located at the left abutment were destroyed during the 2003/2004 boat ramp construction. Mon #1 was replaced with mon. #20000. Mon #31 was not replaced with a new monument. For future surveillance purposes, however, mon #30 will replace mon #31 as the left abutment endpoint in the U/S and D/S monument groups (as noted above in section 4.0, mon. #30 is a new control point for determining local transverse displacement).

Table 3-1 summarizes new vertical and "local transverse displacement" data for the crest and abutment monuments. Beginning with this report, the tabulated survey data (Tables 3-1 and 3-2) include a row that shows the change in displacement since the last survey and average change since last survey, for each data set. As stated above, in our interim reports we are no longer including summarizes of recent northings, eastings, and resultant vector survey data for monuments. However, we will be including these data in our 5-year summary reports.

Figures 5 through 10 are recent plots of vertical and "local transverse displacements", and "local transverse displacement vectors" of surface monuments. The most recent data, obtained since our last report, from December 2002 to November 2003, is shown as a shaded region or arrows on the figures.

The data presented indicates essentially no significant local transverse or vertical displacements (zero to 0.02 ft, or 0.24 in) have occurred during this period.

4.2 Spillway Training Wall Monuments

Three survey monuments are located at the top of the spillway training walls, two on a wall on the left side of the spillway ogee (#14 and #15) and one on a wall on the right side of the ogee (#13) as shown on Figure 1. It should be noted that mon. #13, on the right spillway wall has not been monitored since October 2001 because of difficult access by the surveyors.

Table 3-2 summarizes new vertical displacement data for the spillway training wall monuments. We also included calculated movements since the 2003 report at the bottom of each data set in all tables. As stated above, in our interim reports we are no longer including summarizes of recent northings, eastings, and resultant vector survey data for monuments. However, we will be including these data in our 5-year summary reports.

Figure 11 is a plot of recent vertical displacements. The most recent data, obtained since our last report, from December 2002 to November 2003, is shown as a shaded region on Figure 11. The data presented indicates essentially no vertical displacements (zero ft) have occurred during this period.

5.0 SIGNIFICANT AND NOTEWORTHY SEISMICITY

To assess seismic impact on Anderson Dam, we evaluate earthquakes in two general categories. One category consists of noteworthy earthquakes, which are defined as having M_L (local magnitude) between about 4 and 5 within about 50 miles of the dam. The second category consists of significant earthquakes, defined as having M_L of about 5 or greater within about 50 miles of the dam. To update noteworthy earthquakes the following paragraphs summarize local seismicity for Anderson Dam for the period from December 2002 through September 2004.

As shown on Figure 12, since December 2002 there were four noteworthy earthquakes with the following magnitude, date, distance, and direction from Anderson Dam:

1. M_L 4.3 on January 7, 2003, 28 miles southeast;
2. M_L 4.2 on February 2, 2003, 43 miles northwest;
3. M_L 4.3 on March 16, 2004, 25 miles south-southeast; and
4. M_L 4.0 on August 30, 2004, 48 miles southeast.

Figure 12, indicates that earthquakes 1 and 2 occurred on the Calaveras fault (2 on the northern segment and 1 on the southern segment), and earthquakes 3 and 4 occurred on the San Andreas fault.

There were no significant earthquakes (defined here as ~ML 5.0 within 50 miles of Anderson Dam) since the magnitude 4.9 "Gilroy earthquake" that occurred on May 14, 2002. Information on this earthquake was included in our 2003 first interim surveillance report (Nelson and Mooers, 2003).

Since our last report was being prepared, a large earthquake of magnitude MW 6.5 occurred on December 22, 2003, at 11:15:56 (PST), with its epicenter located 7 miles northeast of San Simeon on the California coast. The epicenter of this earthquake (35.706° Latitude, 121.101° Longitude) is located about 105 miles at a bearing of 16.4°SE from Leroy Anderson Dam. Appendix B is a copy of a 12/22/03 District memo from R.L. Volpe to D. Hook describing this earthquake and its potential impact on District structures. It is significant to note from this memo that District dam safety criteria requires that if an earthquake of M 5 or greater occurs within 20 mile radius of a District dam, or if a peak ground acceleration greater than 0.05 g is estimated for any earthquake, regardless of distance, then a post-earthquake inspection of District dams will occur. The December 22, 2003 event did not warrant a post-earthquake inspection of the dam.

6.0 ACCELEROMETERS

There are 6 accelerometers at the site (5 on the dam, and one on the left abutment knob) which are owned, maintained and monitored by USGS. These accelerometers were not triggered by any significant seismicity during the current reporting period.

7.0 VISUAL INSPECTIONS

The following significant inspections were performed during the period of this report include:

1. A May 29, 2003, spring inspection of Anderson Dam and appurtenant facilities by DSOD field engineers Andy Mangney and Param Dhillon, along with several District employees (R. Volpe, J. Aguilera, D. Hook, F. Cordova, M. Mooers, H. Haase, M. Sanchez, and J. Nelson).

2. A November 20, 2003, fall inspection of Anderson Dam and appurtenant facilities by DSOD field engineer Andy Mangney, along with several District employees (R. Volpe, J. Aguilera, D. Hook, F. Cordova, T. Ndah, B. O'Mara, and J. Nelson).

These two inspections mark the beginning of DSOD's new procedure of alternately inspecting groups of District dams in spring and fall seasons. The next DSOD inspection of this dam will be in spring 2005.

3. July 19, 2004 marked the first semi-annual District inspection of Anderson Dam by staff of the Dam Safety Section of the District's Infrastructure Planning Unit (R. Volpe, J. Nelson, M. Mooers). These additional safety inspections will focus on maintenance and monitoring issues.

   The July 19, 2004 site visit coincided with the Annual FERC inspection of Anderson Dam and appurtenant structures by FERC engineer Mr. Abbas Orumchian and District personnel (see above).

8.0 SURVEILLANCE PROGRAM

Overall, for the period of November 2002 through September 2004, there were no significant modifications of Anderson Dam or appurtenant structures, and no operational changes were made that would impact the surveillance data or its interpretation, except where noted.

The District will continue with its current operating procedures and scheduled surveillance plans. Piezometers will be read monthly and dam crest monuments will be surveyed annually. In addition, site inspections and monument surveys will be conducted after a significant earthquake or other potentially disruptive activity. We do not anticipate replacement or repair work to be required in the next annual reporting period.

9.0 CONCLUSIONS

Except for two spikes in piezometric data from PPA-2 attributed to suspected operator inexperience, our review of the monitoring data presented herein, does not indicate unusual or abnormal changes in the monitoring data during the subject reporting period. Our review of the surveillance data, and our periodic safety inspections, indicate that Anderson Dam appears to show normal responses to the environment, aging process, and external events.

Recent trends in historic piezometric surface elevations (PSE) for PPA-2 have been relatively consistent in the range of ~el. 490 ft to ~el. 500 ft. However, two peaks (spike 1 and spike 2) have occurred during the current monitoring period. Spike 1 is essentially a single peak of ~el. 506.9 ft, while spike 2 is evident as gradual increasing PSE from April 2004 (~el. 496.5 ft) to September 2004 (~el. 518 ft). While some of the earlier readings were collected by an inexperienced technician the latest reading of ~el. 496 ft (October 18, 2004) from PPA-2 was collected by a more experienced technician (see Figure 3). This value is consistent with historic trends of PPA-2. Consequently, we have tentatively determined that spike 2, and likely spike 1, may have been due to operator inexperience. We will continue to monitor this issue and keep DSOD appraised.

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TABLE 1
Recent Piezometric Data
Leroy Anderson Dam

Date	Reservoir Level	PPA-1	PPA-2	OW-1	Monthly*
	(ft)	Piezometric Surface Elevation (ft)			Rainfall (in)
12/23/02	567.26	569.94	491.74		8.35
1/16/03	580.34	568.56	506.87	---	0.91
2/20/03	579.58	568.21	499.94	---	1.54
3/18/03	579.88	567.52	NR	---	1.54
4/16/03	581.43	566.82	NR	---	2.68
5/15/03	583.77	565.90	NR	---	0.94
6/25/03	584.26	566.82	494.63	---	0.00
7/15/03	583.28	565.90	494.63	---	0.00
8/12/03	582.41	565.67	494.40	&	0.31
9/10/03	577.21	565.21	494.40	406.18	0.00
10/16/03	572.82	565.09	494.63	405.85	0.39
11/13/03	570.49	565.83	493.70	405.85	1.85
12/11/03	572.24	565.83	NR	405.60	5.39
1/26/04	581.90	564.51	494.97	405.99	2.17
2/23/04	583.03	566.13	NR	405.69	4.49
3/15/04	593.51	564.79	494.63	405.75	0.35
4/20/04	592.48	564.98	494.63	406.31	0.00
5/20/04	590.57	564.98	496.47	405.83	0.08
6/22/04	589.49	564.98	502.71	405.90	0.00
7/29/04	588.29	565.44	508.26	405.86	0.00
8/25/04	586.18	565.67	517.73	406.37	0.00
9/22/04	583.70	565.67	518.65	406.26	0.00
10/18/04	582.12	566.13	495.78	406.22	1.42

Notes:

1) basis of elevations is NAVD 1988 - values in this table are 2.8 feet higher than NGVD 1929

2) NR = no readings collected

3) & = OW-1 installed 8/5/03

4) shade = rainfall as of 10/21/04

TABLE 2

Recent Weir Discharge Data Spillway Underdrains

Leroy Anderson Dam

Date	Reservoir	Underdrain	flow (gpm)	Total flow
	Level (ft)	Weir No. 1	Weir No. 2	(gpm)
12/23/02	567.26	0.00	0.45	0.45
01/16/03	580.34	0.00	0.45	0.45
02/20/03	579.58	0.00	3.14	3.14
03/18/03	579.88	0.00	1.80	1.80
04/16/03	581.43	2.25	1.80	4.05
05/15/03	583.77	0.90	0.90	1.80
06/25/03	584.26	3.59	1.80	5.39
07/15/03	583.28	2.25	1.80	4.05
08/12/03	582.41	0.90	1.80	2.70
09/10/03	577.21	0.45	2.25	2.70
10/16/03	572.82	0.00	0.90	0.90
11/13/03	570.49	0.00	0.45	0.45
12/11/03	572.24	0.00	0.45	0.45
01/26/04	581.90	0.45	0.90	1.35
02/23/04	583.03	1.80	2.25	4.05
03/15/04	593.51	10.80	3.14	13.94
04/20/04	592.48	18.90	3.14	22.04
05/20/04	590.57	14.80	2.25	17.05
06/22/04	589.49	14.80	2.25	17.05
07/29/04	588.29	12.60	3.59	16.19
08/24/04	586.18	10.80	1.80	12.60
09/22/04	583.70	6.29	1.80	8.09
10/18/04	582.12	4.94	1.80	6.74

Notes: 1) Weir No. 1 collects flow from the central portion of spillway
2) Weir No. 2 collects flow from the left side of the spillway

TABLE 3-1

Vertical and Local Transverse Data -Crest and Abutment Monuments

Leroy Anderson Dam

Date	Monument Vertical Displacement (feet)															
	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
10/15/2002	0.01	-0.07	-0.09	-0.27	-0.21	-0.34	-0.30	-0.23	-0.36	-0.19	-0.15	-0.09	-0.02	-0.01	0.01	0.00
11/04/2003	0.01	-0.08	-0.09	-0.28	-0.22	-0.36	-0.31	-0.24	-0.37	-0.20	-0.16	-0.08	-0.03	-0.01	0.01	NR
change in disp.	0.00	0.00	0.00	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	0.00	-0.01	0.00	-0.01	0.00	0.00	NR
since last survey		Average change since last survey =					-0.01	or 0.12"								

Date	Dam Crest Monument Local Transverse Displacement (feet)														
	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
07/19/1988	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10/24/1989	0.00	-0.04	0.03	-0.04	0.04	-0.03	0.03	-0.02	-0.07	0.03	-0.02	0.02	0.00	0.00	0.00
10/28/1990	0.00	-0.02	0.03	-0.04	0.04	-0.01	0.06	0.02	-0.04	0.06	-0.01	0.04	0.00	-0.01	0.00
06/07/1991	0.00	-0.01	0.07	-0.03	0.06	-0.03	0.04	-0.02	0.00	0.05	0.00	0.04	0.01	-0.01	0.00
01/08/1992	0.00	-0.03	0.05	-0.02	0.07	-0.01	0.06	-0.01	-0.06	0.06	-0.01	0.04	0.00	-0.01	0.00
01/27/1993	0.00	-0.03	0.05	-0.03	0.06	-0.01	0.05	-0.01	-0.06	0.05	-0.01	0.04	0.00	0.00	0.00
11/01/1994	0.00	-0.03	0.03	-0.09	0.00	-0.10	0.00	-0.06	-0.11	0.02	-0.03	0.03	0.00	-0.01	0.00
12/05/1994	0.00	-0.04	0.03	-0.07	0.02	-0.08	0.01	-0.06	-0.11	0.02	-0.03	0.03	-0.01	-0.01	0.00
01/04/1996	0.00	-0.03	0.00	-0.13	-0.05	-0.14	-0.03	-0.11	-0.17	-0.01	-0.06	0.03	-0.01	-0.01	0.00
05/22/1996	0.00	-0.05	0.01	-0.12	-0.03	-0.13	-0.04	-0.10	-0.14	0.01	-0.05	0.04	-0.01	-0.01	0.00
01/29/1997	0.00	-0.05	-0.01	-0.14	-0.06	-0.17	-0.05	-0.12	-0.17	-0.02	-0.06	0.02	-0.01	0.00	0.00
12/10/1998	0.00	-0.08	-0.06	-0.16	-0.09	-0.18	-0.05	-0.12	-0.18	-0.01	-0.05	0.04	0.00	-0.02	0.00
12/03/1999	0.00	-0.05	-0.01	-0.14	-0.06	-0.18	-0.05	-0.13	-0.18	-0.02	-0.06	0.04	-0.01	-0.01	0.00
11/28/2000	0.00	-0.04	0.01	-0.13	-0.06	-0.17	-0.05	-0.14	-0.18	-0.02	-0.06	0.04	0.00	-0.02	0.00
10/18/2001	0.00	-0.04	0.01	-0.12	-0.05	-0.16	-0.04	-0.12	-0.16	0.00	-0.05	0.05	-0.01	-0.02	0.00
10/15/2002	0.00	-0.03	0.01	-0.10	-0.03	-0.14	-0.02	-0.11	-0.15	0.01	-0.04	0.06	0.00	-0.01	0.00
11/04/2003	0.00	-0.03	0.02	-0.12	-0.02	-0.14	-0.02	-0.11	-0.17	-0.02	-0.06	0.06	-0.02	-0.01	0.00
change in disp.	0.00	0.00	0.00	-0.01	0.00	0.00	0.01	0.00	-0.02	-0.03	-0.02	0.00	-0.02	0.01	0.00
since last survey		Average change since last survey =					-0.01	or 0.12"							

Notes:

1) Negative transverse displacement signifies downstream movement
2) Positive transverse displacement signifies upstream movement
3) Displacement is net displacement since 1988
4) NR = monument not surveyed
5) Local Transverse data shown back calculated to 1988 - see text
6) Mon #31 destroyed 2003/04 - see text
7) Mons #16 and 31 are control points and do not show local transverse displacement

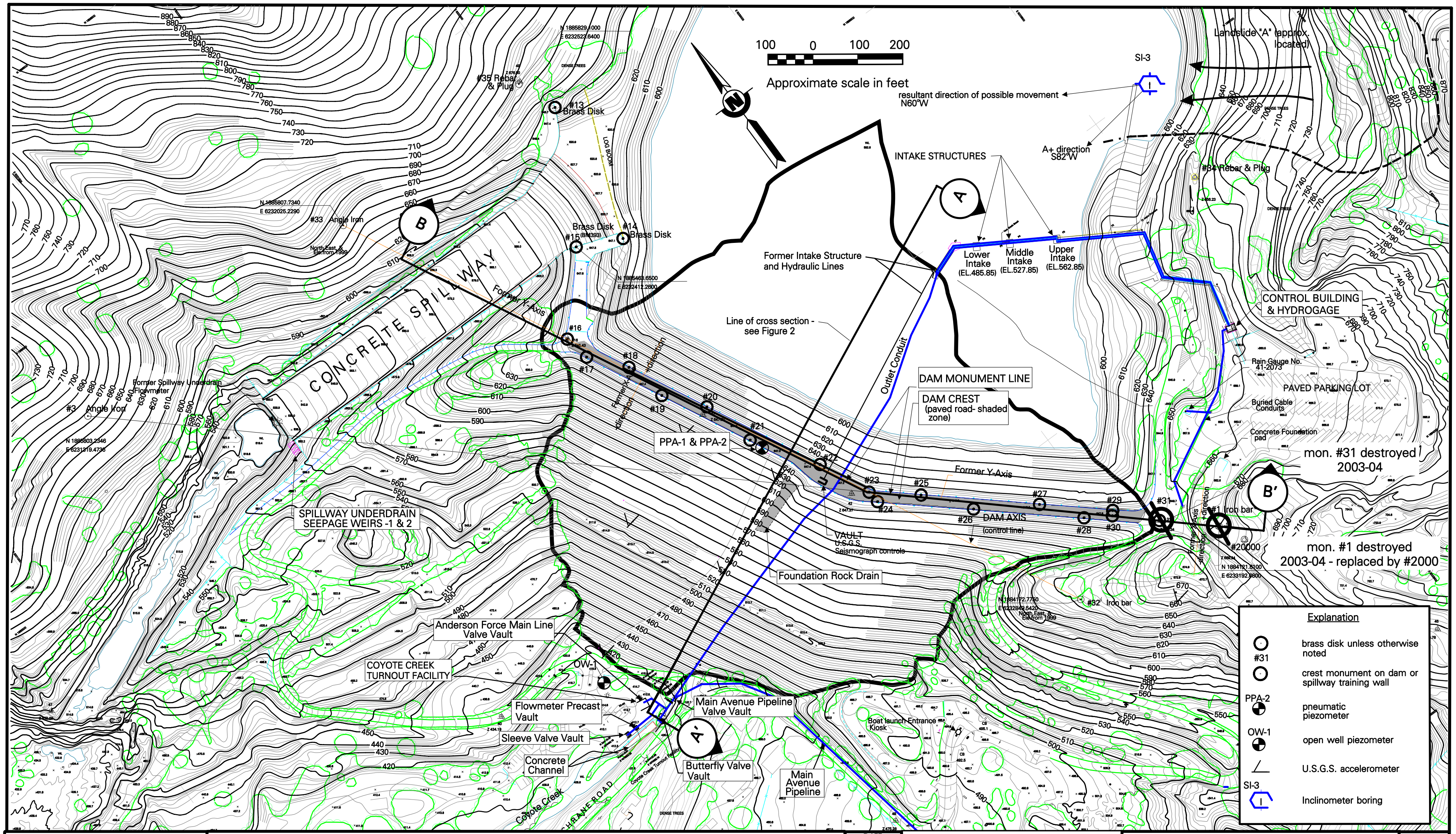
TABLE 3-2
Vertical Displacement Data
Spillway Monuments
Leroy Anderson Dam

Date	Monument Vertical Displacement (feet)		
	13	14	15
10/18/2001	0.03	-0.01	0.00
10/15/2002	NR	-0.01	0.00
11/04/2003	NR	-0.01	0.00
change in disp. since last survey	NR	0.00	0.00
Average change since last survey =	0.00	or 0.0"	

Notes:

1) Negative vertical displacement represents settlement

2) Positive vertical displacement represents heave


100 0 100 200
Approximate scale in feet
Landslide "A" (approx. located)
SI-3
resultant direction of possible movement N60°W
A+ direction S82°W
#34 Rebar & Plug
INTAKE STRUCTURES
Lower Intake (EL.485.85)
Middle Intake (EL.527.85)
Upper Intake (EL.562.85)
Former Intake Structure and Hydraulic Lines
Line of cross section - see Figure 2
Outlet Conduit
CONTROL BUILDING & HYDROGAGE
Rain Gauge No. 41-2073
PAVED PARKING LOT
Buried Cable Conduits
Concrete Foundation pad
mon. #31 destroyed 2003-04
mon. #1 destroyed 2003-04 - replaced by #2000
#1 Iron bar
#20000
#32 Iron bar
DAM MONUMENT LINE
DAM CREST (paved road- shaded zone)
Former Y-Axis
DAM AXIS (control line)
VAULT U.S.G.S. Seismograph controls
Foundation Rock Drain
PPA-1 & PPA-2
#16
#17
#18
#19
#20
#21
#22
#23
#24
#25
#26
#27
#28
#29
#30
#31
+direction
-direction
#35 Rebar & Plug
#13 Brass Disk
LOG BOOM
#15 Brass Disk (BM393)
#14 Brass Disk
#33 Angle Iron
North East & Elev.from 1999
#3 Angle Iron
Former Spillway Underdrain Flowmeter
CONCRETE SPILLWAY
SPILLWAY UNDERDRAIN SEEPAGE WEIRS -1 & 2
Anderson Force Main Line Valve Vault
COYOTE CREEK TURNOUT FACILITY
OW-1
Flowmeter Precast Vault
Sleeve Valve Vault
Concrete Channel
Main Avenue Pipeline Valve Vault
Butterfly Valve Vault
Main Avenue Pipeline
Boat launch Entrance Kiosk
Coyote Creek
COCHRANE ROAD
DENSE TREES
A
A'
B
B'
N
Explanation
#31 brass disk unless otherwise noted
crest monument on dam or spillway training wall
PPA-2 pneumatic piezometer
OW-1 open well piezometer
U.S.G.S. accelerometer
SI-3 Inclinometer boring

Reference information and notes:
1) This map is a compilation of aerial mapping, survey field data, and digitized construction maps. Maximum error could be ± one foot vertical and horizontal
2) Grid is based on California Coordinate System, Zone III, NAD 83.
3) Elevations based on N.G.S. Vertical datum, NAVD 88. The DE between NAVD 29 and NGVD 88 is 2.80'
4) Photogrammetric mapping: Transvision, Photo date 12/11/97
5) * control point #1 destroyed 2003-04 during boat ramp work and replaced by #20000
6) file W:\geology\dams\annual dam safety report\DSOD\2003-04 report\DSOD\ANDfig1-04.cdr

revised 10/21/04

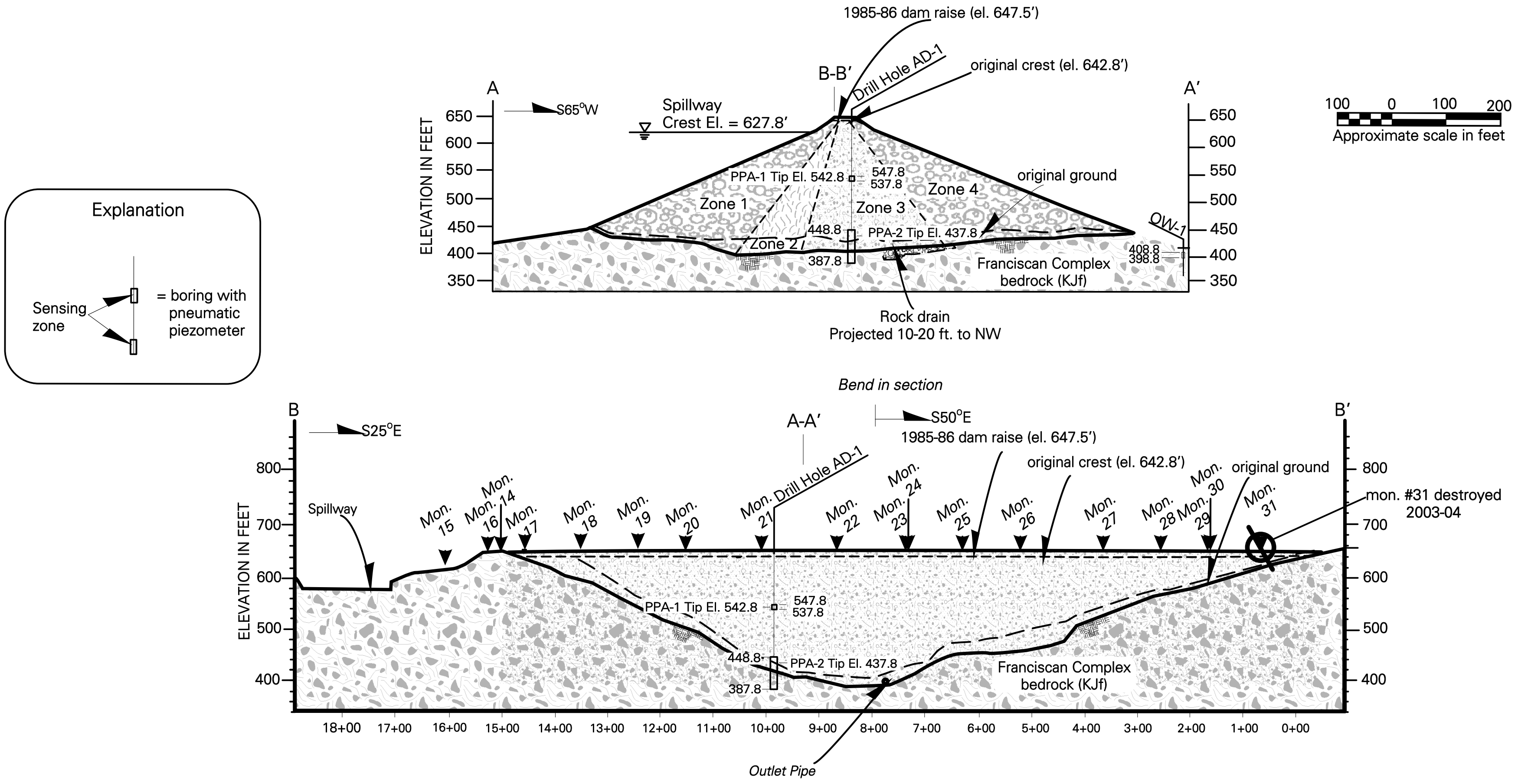
DATE	03/24/03
DESIGN	JLN
DRAWN	BLS
CHECKED	JLN

Santa Clara Valley Water District

Topographic Map
Leroy Anderson Dam (No. 72-9)
Surveillance Instrumentation

SCALE
1" = 200'

FIGURE
1



Note: 1) basis of elevation is NAVD 1988 -
elevations on this section are 2.8 feet higher
than those dated earlier than 1998
2) file: W:\geology\dams\annual dam safety reports\DSOD\Anderson Dam\2003-04\andfig2-04.cdr

revised 10/21/04

DATE	12/02/00
DESIGN	JLN
DRAWN	JLN
CHECKED	RLV

Santa Clara Valley Water District

Cross Sections A-A' & B-B'

Leroy Anderson Dam (No. 72-9)

Piezometer Locations

SCALE
1" = 200′

FIGURE
2

LEROY ANDERSON DAM (NO. 72-9)

Santa Clara Valley Water District

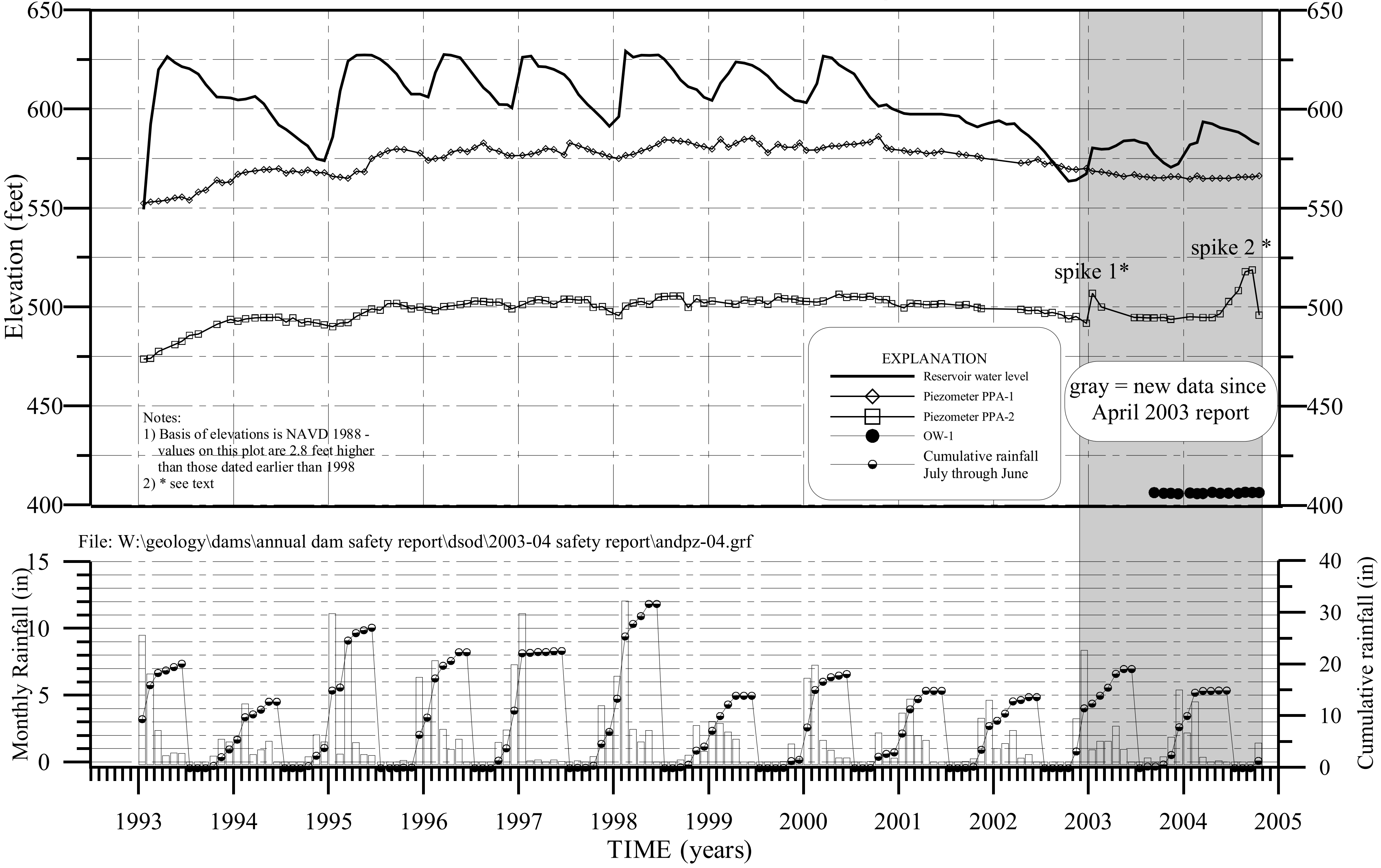


Figure 3. Piezometer Levels - Embankment

LEROY ANDERSON DAM (NO. 72-9)

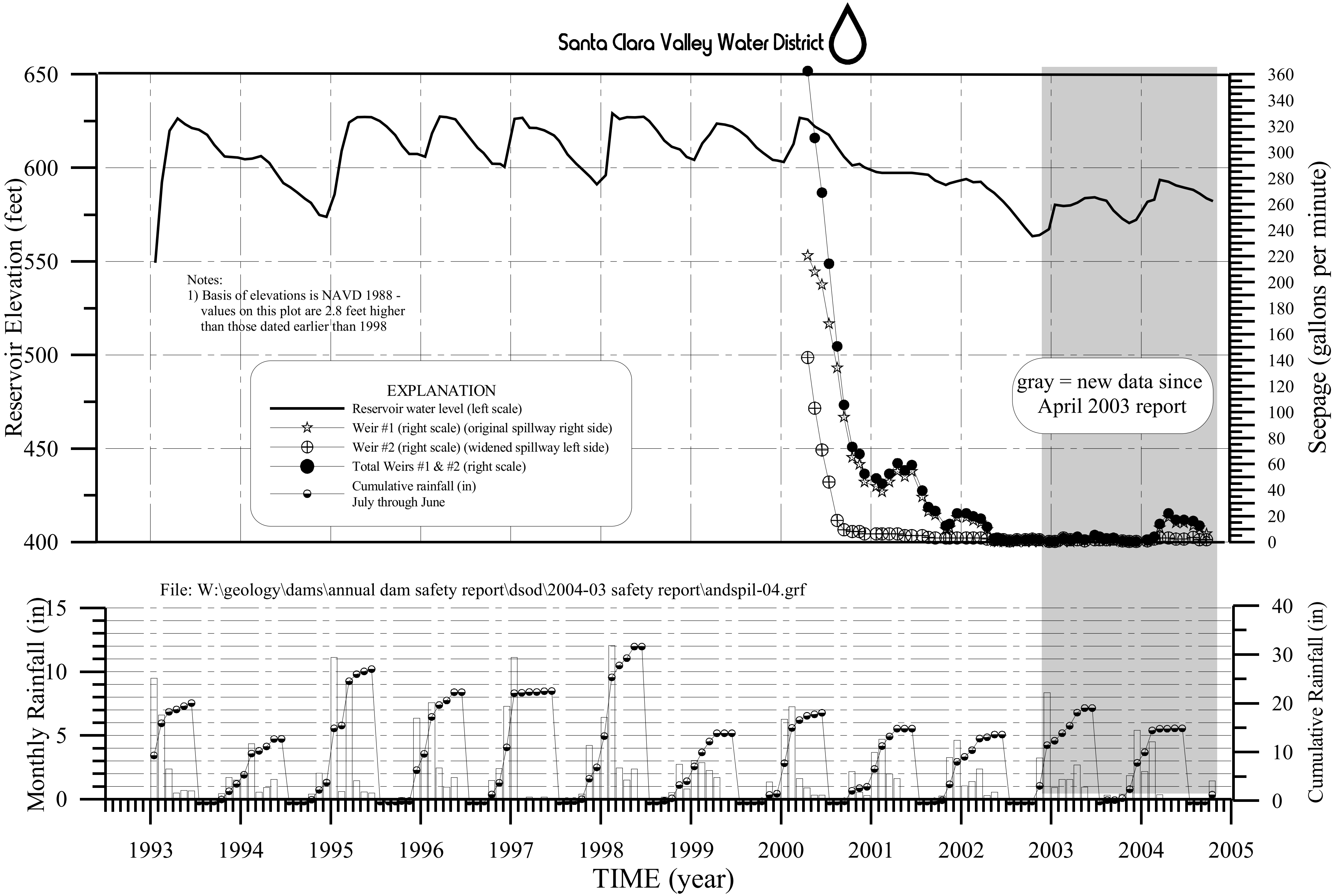


Figure 4. Weir Discharge Data - Spillway Underdrains

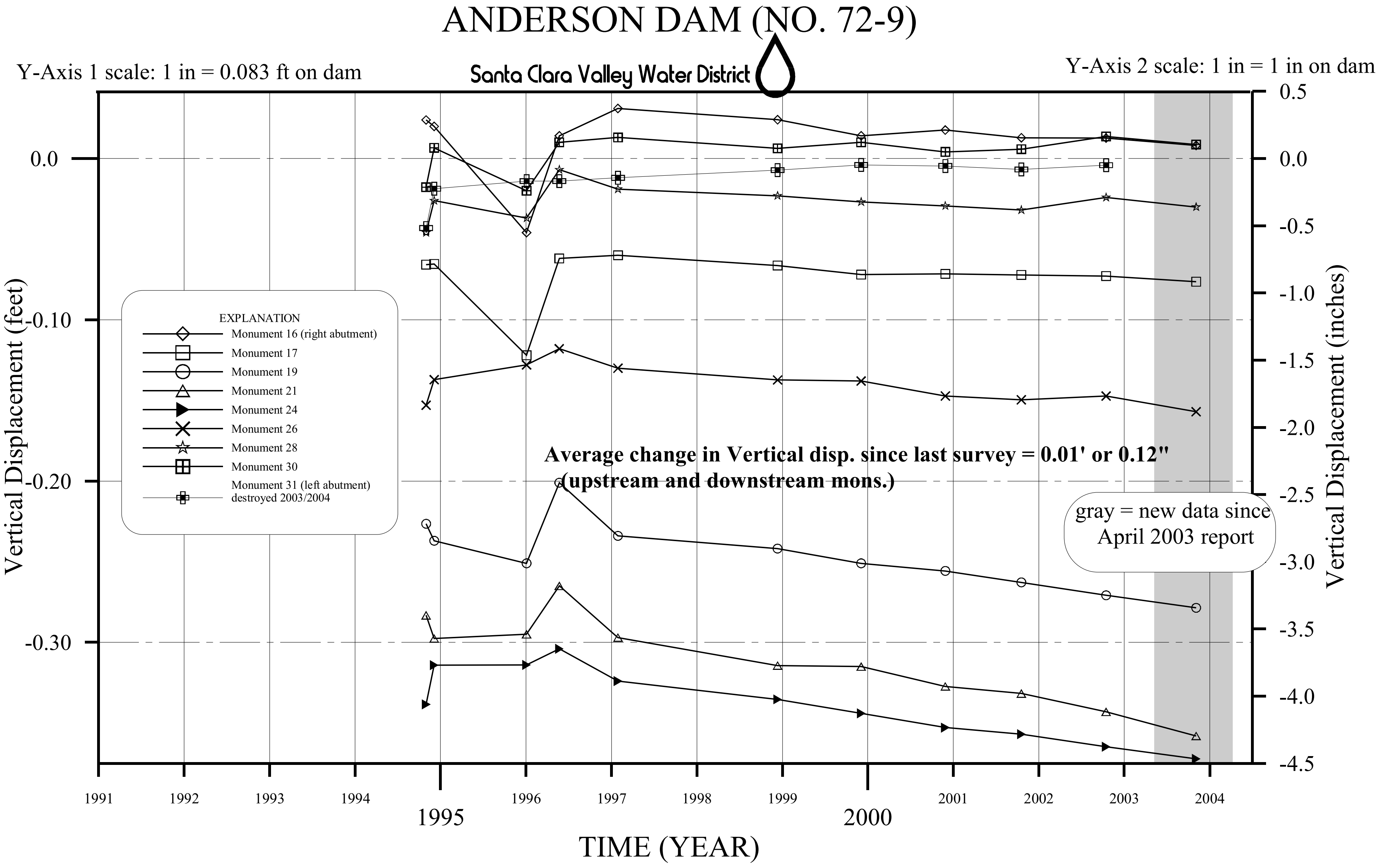


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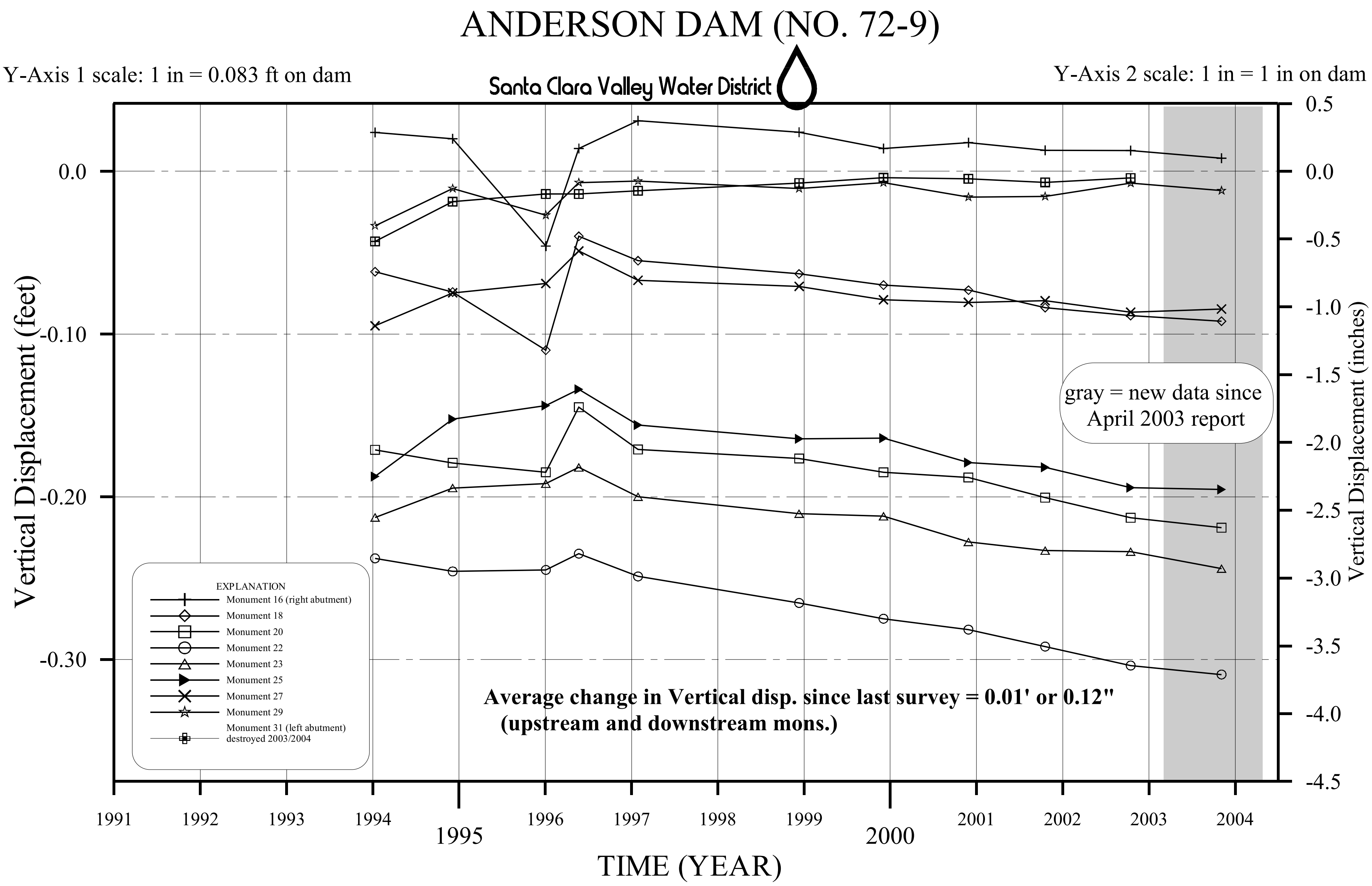
Figure 5 - Vertical Displacements - Monuments at Downstream Edge of Crest

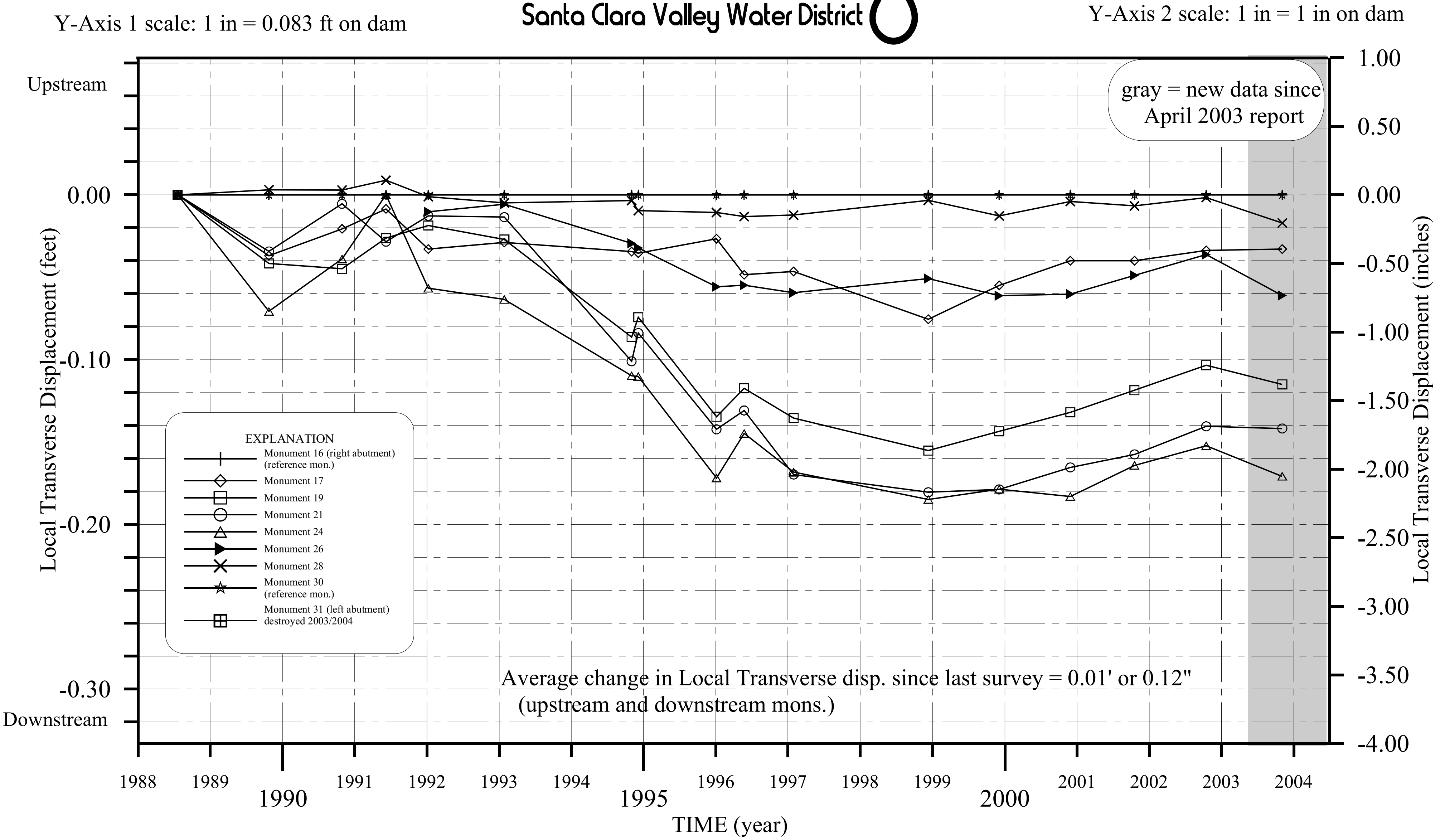


File W:\geology\annual dam safety reports\dsod\anderson\2003-04revised\andvert2-04.grf

Figure 6 - Vertical Displacements - Monuments at Upstream Edge of Crest

ANDERSON DAM (NO. 72-9)

Santa Clara Valley Water District



File: W:\geology\annual dam safety reports\dsod\anderson\2003-04revised\andla10y-04rev.grf

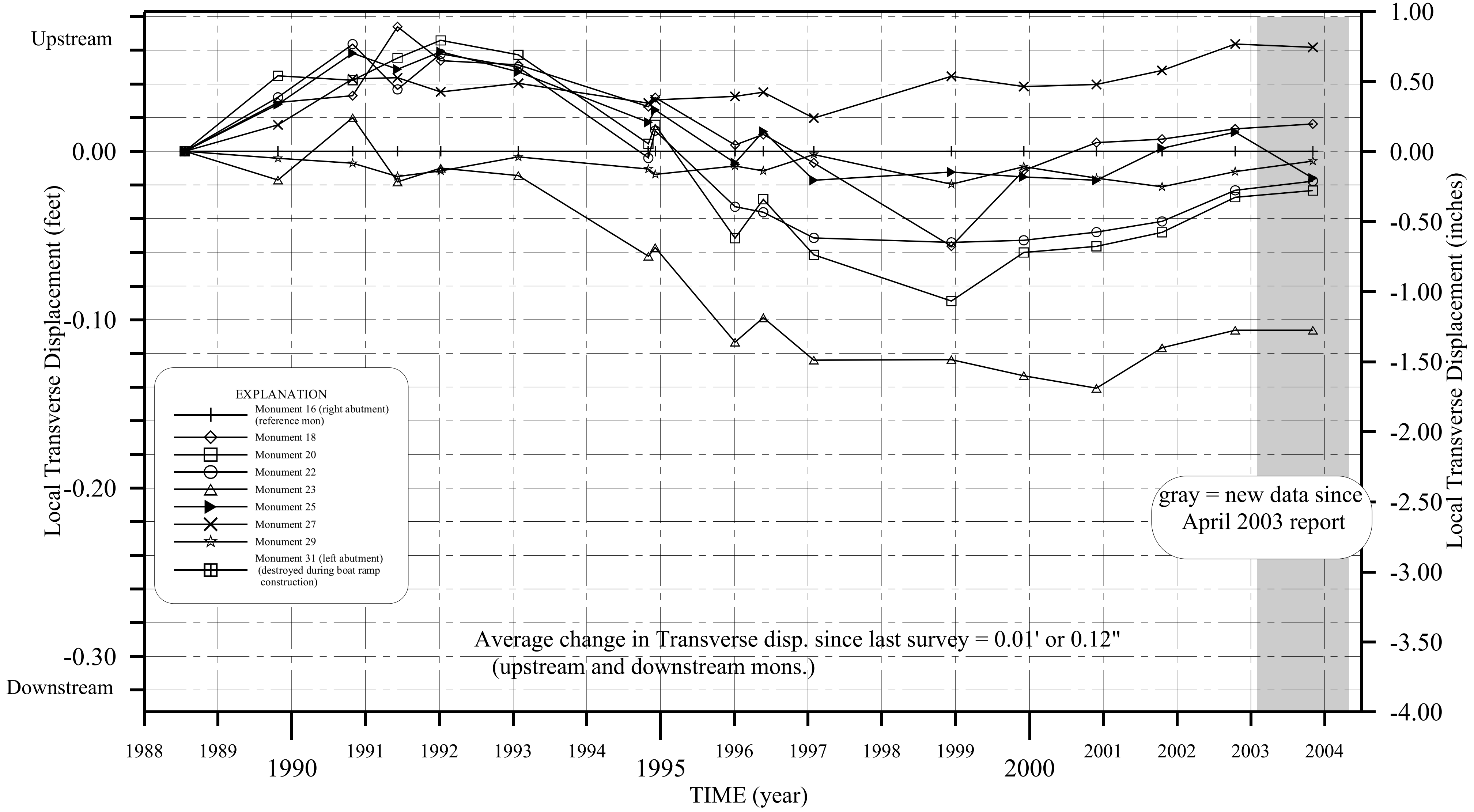
Figure 7 - Local Transverse Displacements - Monuments at Downstream Edge of Crest

ANDERSON DAM (NO. 72-9)

Santa Clara Valley Water District

Y-Axis 1 scale: 1 in = 0.083 ft on dam

Y-Axis 2 scale: 1 in = 1 in on dam

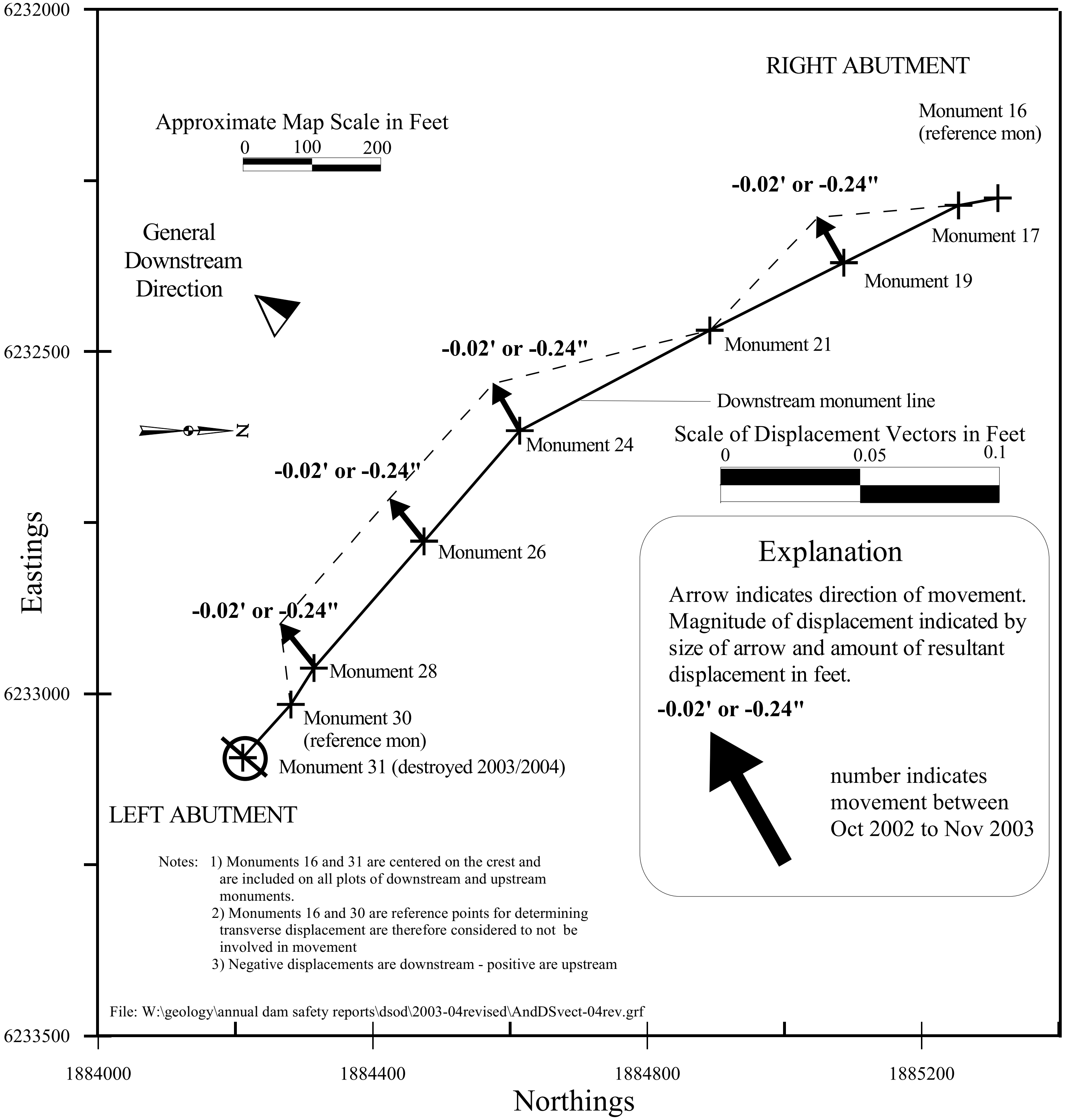


File: W:\geology\annual dam safety reports\dsod\anderson\2003-04revised\andl10y-04rev.grf

Figure 8 - Local Transverse Displacements - Monuments at Upstream Edge of Crest

LEROY ANDERSON DAM (No. 72-9)

Santa Clara Valley Water District



Arrow indicates direction of movement. Magnitude of displacement indicated by size of arrow and amount of resultant displacement in feet.

number indicates movement between Oct 2002 to Nov 2003

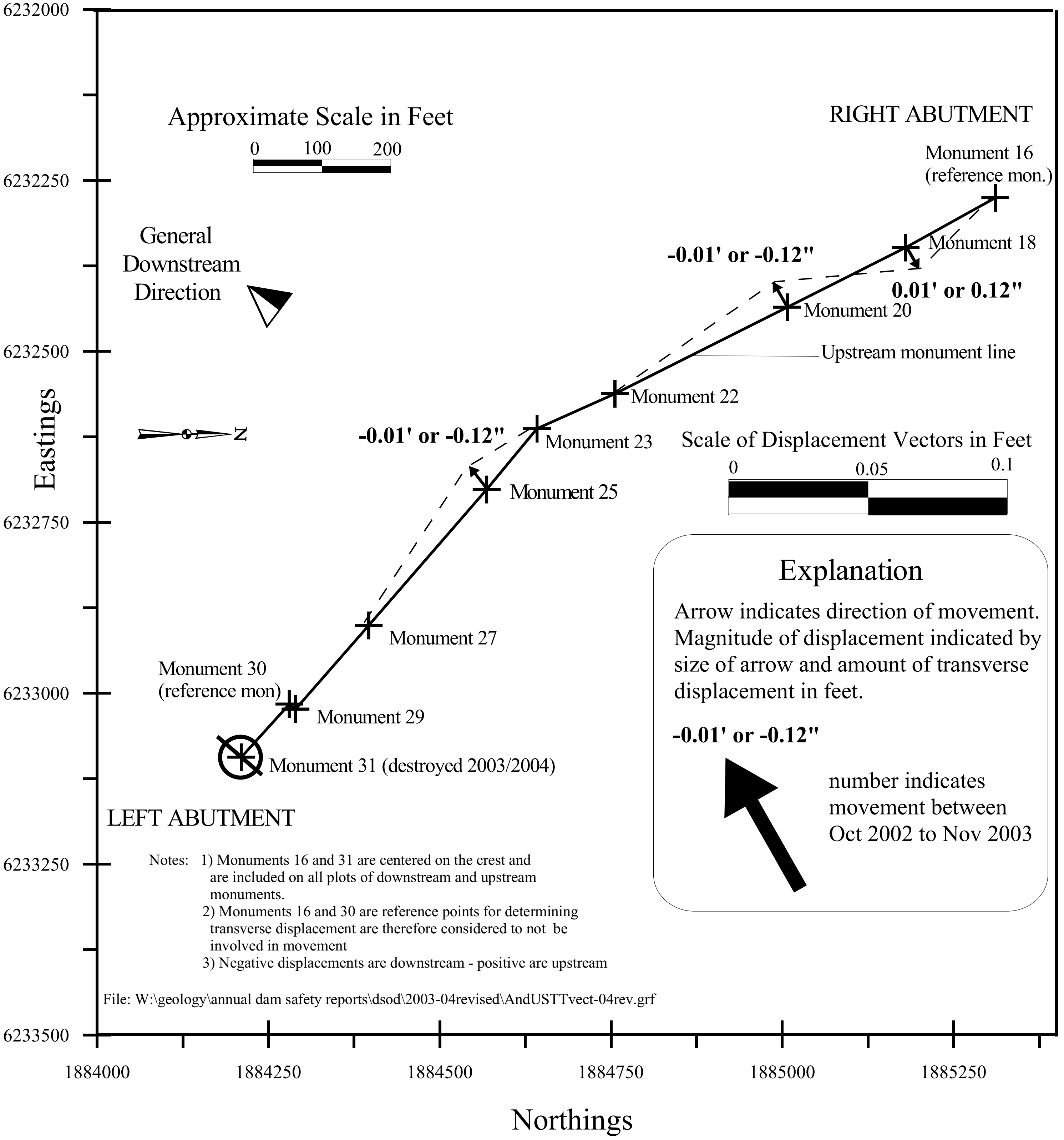
Notes: 1) Monuments 16 and 31 are centered on the crest and are included on all plots of downstream and upstream monuments.
2) Monuments 16 and 30 are reference points for determining transverse displacement are therefore considered to not be involved in movement
3) Negative displacements are downstream - positive are upstream

File: W:\geology\annual dam safety reports\dsod\2003-04revised\AndDSvect-04rev.grf

Figure 9 - Oct 2002 to Nov 2003 Local Transverse Displacement Vectors - Monuments at Downstream Edge of Crest

LEROY ANDERSON DAM (No. 72-9)

Santa Clara Valley Water District



Explanation

Arrow indicates direction of movement. Magnitude of displacement indicated by size of arrow and amount of transverse displacement in feet.

-0.01' or -0.12"

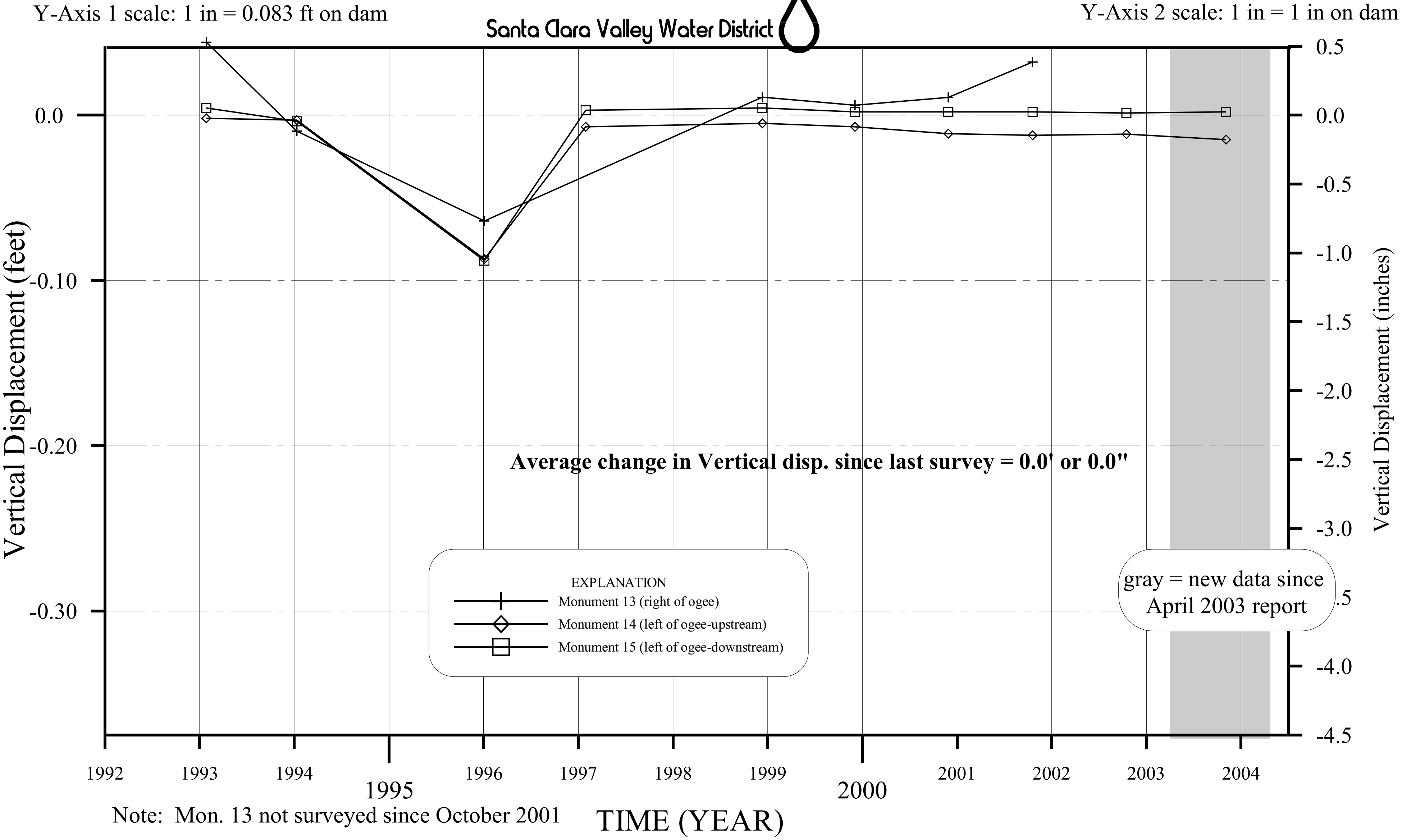
number indicates movement between Oct 2002 to Nov 2003

Notes:
1) Monuments 16 and 31 are centered on the crest and are included on all plots of downstream and upstream monuments.
2) Monuments 16 and 30 are reference points for determining transverse displacement are therefore considered to not be involved in movement
3) Negative displacements are downstream - positive are upstream

File: W:\geology\annual dam safety reports\dsod\2003-04revised\AndUSTTvect-04rev.grf

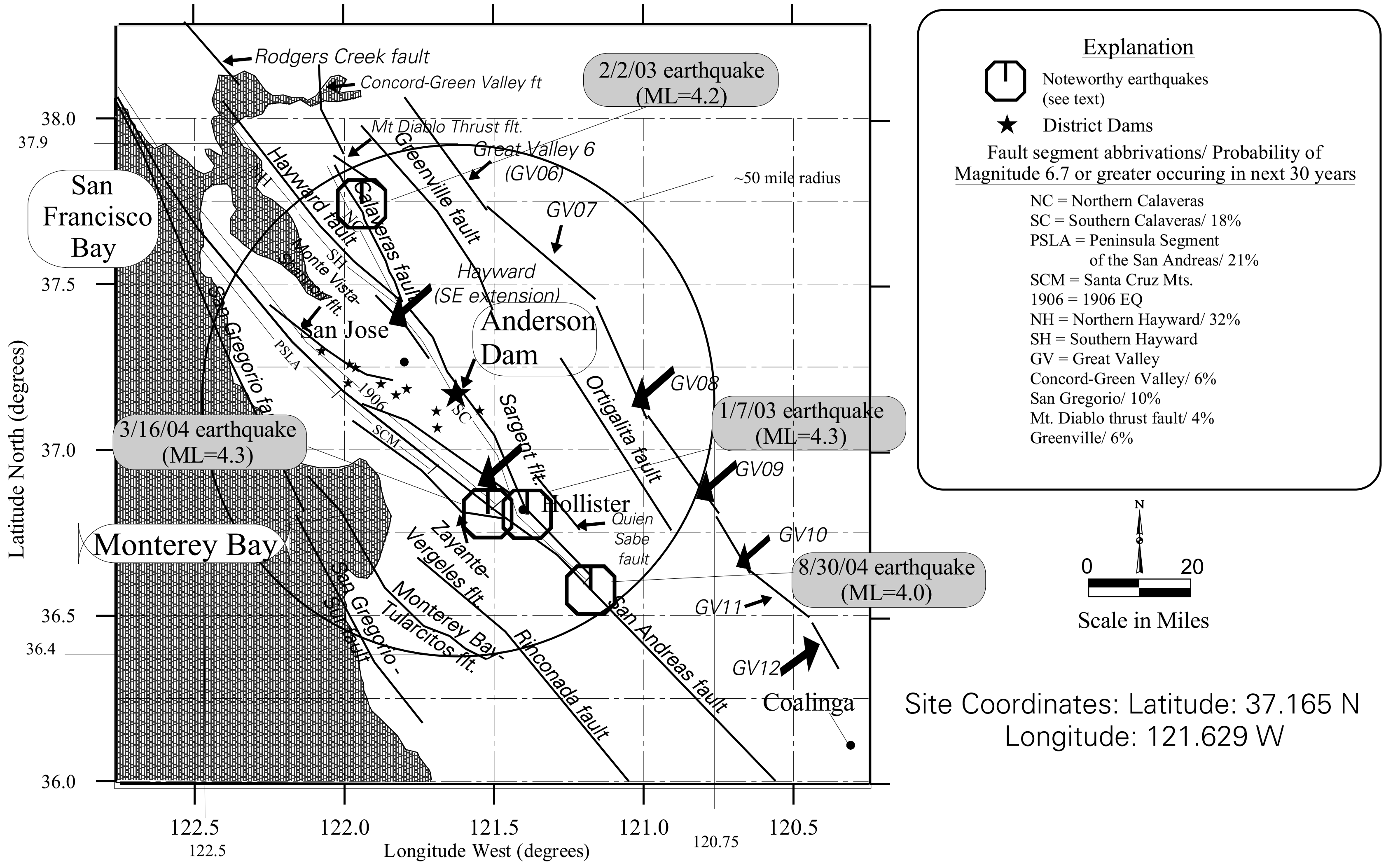
Figure 10 - Oct 2002 to Nov 2003 Local Transverse Displacement Vectors - Monuments at Upstream Edge of Crest

ANDERSON DAM (NO. 72-9)



File W:\geology\annual dam safety reports\dsod\anderson\2003-04revised\andvert3-04.grf

Figure 11 - Vertical Displacements - Spillway Training Walls



Site Coordinates: Latitude: 37.165 N
Longitude: 121.629 W

Notes: 1) File W:\geology\dams\annual dam safety reports\dsod\2003-04 report\Andseis-04.grf

DATE	12/11/02
DESIGN	JLN
DRAWN	JLN
CHECKED	RLV

Santa Clara Valley Water District

Regional Fault Map, Showing Noteworthy Earthquakes

Anderson Dam (No. 72-9)

SCALE
1"=20'

FIGURE
12

Appendix A

Anderson Dam Observation Well OW-1, Drilling and Well Construction Report, August 11, 2003 memorandum from J.L. Nelson to R.L. Volpe.

Santa Clara Valley Water District

MEMORANDUM

TO: Richard L. Volpe, G.E.
Senior Engineer

FROM: James L. Nelson, C.E.G.
Associate Engineering Geologist

SUBJECT: Anderson Dam Observation Well OW-1
Drilling and Well Construction Report

DATE: August 11, 2003

1.0 Project Purpose and Description

The Anderson Dam Observation Well Project consisted of installing a monitoring well near the downstream toe of Anderson Dam to measure and observe the presence of seepage. This work was performed at the request of the Federal Energy Regulatory Commission (FERC) in response to FERC concerns that near-surface seepage could be occurring near the downstream toe and that the seepage can not be adequately monitored because it does not appear at the ground surface.

The purpose of the observation well is to allow routine monitoring of potential foundation seepage. It is assumed that the groundwater conditions at the well location are strongly influenced by seepage from the dam. Consequently, the observation well will enable the District to monitor groundwater levels at various reservoir level operations and thus allow assessment of corresponding seepage conditions.

The District initially proposed using standard PVC casing for the well. FERC provided the following comments recommending the use of stainless steel casing for proposed construction of the well in a letter dated June 24, 2003.

Section 2a, page 1: *"The Leroy Anderson Dam site is located in a high seismic area. The proposed 4-inch diameter 20-30 feet deep PVC casing pipe may shear-off during high earthquake loading. Use of high strength stainless perforated steel pipe, typically used for recharge wells, is very common for areas with high seismic potential. After the earthquake disasters the rate of recovery of wells with the stainless steel casing is usually higher that with the PVC installation."*

Section 2b, page 2: *"The area of the compressed pellets Bentonite seal around the PVC casing during the earthquake usually expands and often shifts the alignment of the PVC pipe. However, continued stainless steel pipe in this area may have more resistance to lateral loading."*

2.0 CEQA Requirements

The project qualified for a Categorical Exemption under CEQA Guidelines Section 15306 and applicable documents were recorded with Santa Clara County Clerk on January 6, 2003.

3.0 Field Drilling and Well Construction Activities

The well was drilled and constructed on August 4 and 5, 2003, directly downstream of the dam toe, near the Toyon Picnic Area operated by the Santa Clara County Parks and Recreation, adjacent to existing paved parking area near the confluence of Coyote Creek and Cochrane Road, about 2 miles due east of Morgan Hill, California, as shown on attached Figure 1.

Construction of the observation well consisted of drilling a bore hole with an air rotary drill rig, operated by Maggiora Bros. Drilling, Inc. of Watsonville, California. The boring was advanced about 52 feet deep with a diameter of ~8.5 inches. This diameter accommodated 4.5-inch outside diameter (O.D.) stainless steel casing; thus meeting State requirements for 2 inches of clearance between the boring sidewall and the casing. I logged the exploratory boring and recorded the following pertinent field and office data pertaining to the well.

The well was completed using standard well construction procedures listed below. The attached boring log record subsurface field conditions and well construction details.

1) Obtained Well Construction permit No. 03W00370 issued 6/17/03 from District Wells Section;
2) Notified Underground Service Alert and County Parks and Recreation of District's intent to drill well;
3) Drilled boring to a depth of ~52 feet, of which the bottom ~34 feet caved after removal of the drill string. The caved portion provided native backfill for the bottom of the well and allowed construction of an approximately 18-foot-deep well.
4) Installed slotted 4.5 inch O.D. stainless steel casing with 0.04" slots, from a depth of ~18 feet to a depth of ~8 feet and blank 4.5 inch O.D. stainless steel casing from ~8 feet to ground surface, with ~2 feet of stick up;
5) Placed a filter pack of #8 Monterey sand (~1/16" dia.) around the slotted portion in the annular space between the edge of the hole and the outside edge of the casing to enable ground water/seepage to easily enter the well;
6) Placement adjacent to the unscreened section of pipe in the annular space about 1 foot of bentonite pellets above the filter material. The bentonite seal was overlain by tremmied cement grout in accordance with SCVWD well construction requirements surface seal in the upper 8 feet;
7) Saw cut the casing slightly below ground surface and installed a Christy box and locking well cap slightly above ground surface, and;
8) Completed State Well Completion Log (State Form 188) and submitted to Well Section.

Follow-up work will include:

9) Pump well to develop and remove sediments adjacent to the filter pack.
10) Survey location of well.
11) Begin monthly water level readings of OW-1 by District staff.

4.0 Subsurface Soil and Geologic Conditions

To evaluate local geologic conditions in the vicinity of OW-1, I compiled data from my field boring log with pertinent preconstruction geologic data and developed a geologic cross section for analysis. The attached boring log shows my field interpretation of subsurface conditions in the vicinity of OW-1. Figure 1 shows the location of OW-1 and general preconstruction surface geology from a map by Engineering Geologist Chester Marliave presented in his September 15, 1949 report, obtained from Division of Safety of Dam files in Sacramento. Figure 2 shows my interpretation of subsurface geologic conditions.

Also shown on Figure 2 are lines depicting ground surface in the vicinity of OW-1 at three different times. This allows one to view and compare changes in ground surface with time and assists interpretation of likely pre-construction and post-construction geologic conditions. Elevations of each ground surface line are based on approximate 1988 datum (NGVD 1988), with the older two elevations corrected by adding about 3 feet. The green dashed blue line is pre-construction (~1949) ground surface geologic map by Marliave. The black dashed line is based on the as-built drawings of completed Anderson Dam dated 1951. The dashed purple line is based on photogrammatic mapping from photos flown in December 1997. The benefits of comparing Marliave's map with the later maps is that it allows one to assess the relationship of the original topography and geologic conditions to subsequent changes in topography due to cuts and fills made during dam construction, and any other later alterations. It also allows one to make reasonable assumptions of the overall geometry of the basin incised into adjacent bedrock and the in-filled valley alluvial materials.

My observations of cuttings collected from the air rotary drill rig on August 4 and 5, 2003, (see attached boring log and Photo Nos. 1 through 5) indicate that OW-1 is underlain by about 11 to 12 feet of artificial fill, which is in turn underlain by alluvial (stream deposited) materials. The upper fill consisted of poorly graded gravel and clayey gravel to gravelly clay with low to medium plasticity. The fills were dry to damp and contained angular fragments of predominantly greenstone bedrock. The angular nature of the gravels suggests that the rotary bit was cutting into coarse materials, possibly cobbles and boulders.

At a depth of about 12 feet the cuttings were less clayey, moist to wet, and contained fairly well rounded sands and gravels, indicative of saturated native alluvial materials. From about 12 feet to 14 feet the alluvium was gravelly sand to sandy gravel that was well rounded medium coarse sand and fine gravel up to about ¾" (see Photo 1 of cuttings at 12 feet). From about 14 feet to 17.5 feet the alluvium was sandy gravel that was subangular to subrounded coarse sand to local fine gravel up to about ¾" (see Photo 2 of cuttings at 14 feet). From 17.5 feet to bottom of boring at about 52 feet the alluvium was gravelly sand that was subangular to subrounded medium to coarse sand and local fine gravel up to about ¾" (see Photos 3, 4 and 5 of cuttings at 18', 25', and 52', respectively).

Initial ground water was encountered at a depth of about 14 feet while drilling on August 4, 2003. When the well was completed on August 5, ground water had risen to a depth of about 11 feet. These depths generally correspond to the artificial fill/alluvium contact. The well was specifically completed with screening between 8 feet and 18 feet to attempt to monitor this zone. Subsequent monitoring of OW-1 will determine how ground water responds to fluctuations in Anderson reservoir levels.

Marliave's mapping (Figure 1) indicates that the alluvial valley incised by Coyote Creek is about 300 feet wide in the vicinity of OW-1. The northern and southern banks of the Coyote creek channel that was active just before dam construction is situated between 30 feet and 80 feet, respectively, south of OW-1. Observation well OW-1 appears to be located fairly close to the axis of the valley, where it is about 160 feet south of relatively steep mountainous slopes underlain by Franciscan Complex sandstone and shale and about 140 feet north of relatively flatter slopes underlain by Franciscan Complex rocks and deep residual clay soils.

A comparison of topographic profiles shown on Figure 2 indicates that during dam construction, bedrock excavation was extensive beneath the northern mountainous slopes, with removal of up to about 40 feet of overburden. Conversely, the slopes south of OW-1 do not appear to have changed as a result of construction. In addition, the valley floor just south of OW-1 appears to have received fill up to about 15 feet thick. Most of this fill appears to have been placed sometime between dam construction and the present, possibly during construction of the surrounding parking lot and picnic area.

Prior to drilling, we anticipated that bedrock would likely be relatively shallow, possibly less than 20 feet in the vicinity of OW-1. However, we did not encounter bedrock at the bottom of the boring at a depth of about 52 feet. Although we attempted to drill deep enough to reach bedrock, it was not in the scope to drill to significant depths. The presence of relatively thick valley fill alluvium so close to the toe of the dam (within 50 feet) is somewhat surprising because we expect that the dam foundation was taken down to competent bedrock.

Original signed by:

James L. Nelson, C.E.G
Associate Engineering Geologist

Attachements:

1) References cited
2) Boring Log, 5 pages
3) Photo Nos. 1 through 5, soil cuttings from 12', 14', 18', 25', and 52'
4) Figure 1, OW-1 Location and Pre-Construction General Surface Geologic Map
5) Figure 2, OW-1 Section and Pre-Construction and General Surface Geology

cc: S. Oblonsky, D. Hook, M. Mooers, J. Aguilera, J. Nelson, file, records management

References Cited:

Federal Energy Regulatory Commission, 2003, operation inspection June 18, 2003 and approval of proposed observation well: letter from Takeshi Yamashita to Mr. Dave Hook dated June 24, 2003, 2 p.

Marliave, C., 1949, Geological report on Anderson Dam site located across Coyote Creek, Santa Clara County, California, dated September 15, 1949: unpublished consultant's report, 13 p., maps and cross section, geologic map and section scale 1" = 100'.

LOGGED BY: JLN **DATE DRILLED** 8/4/03-8/5/03 **BORING DIA.** ~8.5″ **DRILL HOLE NO.** OW-1

Depth, ft.	Sample No.	Unified Soil Symbol	SOIL DESCRIPTION	MISC. NOTES Note: ~2′ stick up of casing cut flush to ground surface finished with Christy box and locking cap	Well Annular Space Materials	Well Casing
1 2 3 4 5 6		GP	Poorly Graded Gravel; light gray, dry: greenstone rock fragments: gravels up to ~¾″ (artificial fill)	Begin drilling ~3:30 PM 8/4/03 with air rotary rig by Maggiora Bros. Drilling	cement grout	blank stainless steel ~4.5″ O.D.
7		GC-CL	Clayey Gravel to Gravelly Clay; gray, damp, low to medium plasticity, greenstone rock fragments: gravels up to ~¾″ (artificial fill)	~6.4′ top of bentonite →	Bentonite chips	
8				~7.6′ top of sand → 8′ top of slotted/bottom of blank casing →	#8 Monterey Sand (~1/16″dia.)	
9 10						slotted stainless steel ~4.5″ O.D., 0.04″ slots

August 2003

DRILL HOLE LOG
Anderson Dam Open Well
Santa Clara County, California

LOGGED BY: JLN **DATE DRILLED** 8/4/03-8/5/03 **BORING DIA.** ~8.5″ **DRILL HOLE NO.** OW-1

Depth, ft.	Sample No.	Unified Soil Symbol	SOIL DESCRIPTION	MISC. NOTES	Well Annular Space Materials	Well Casing
11	bag sample @ 12′	GC-CL	Clayey Gravel to Gravelly Clay; gray, damp, low to medium plasticity, greenstone rock fragments broken to coarse sand size (artificial fill)	gw 8:10 AM 8/5/03 ▽ harder drillling @~11′ graywacke fragments in cuttings - possible boulders/cobbles	#8 Monterey Sand (~1/16″dia.)	slotted stainless steel ~4.5″ O.D., 0.04″ slots
12 13	bag sample @ 14′	GP-SP	Gravelly Sand to Sandy Gravel; gray, moist to wet, well rounded, medium coarse sand and fine gravel up to ~¾″(alluvium)	gw 4:30 PM 8/4/03 ▽		
14 15 16 17		GP	Sandy Gravel; gray & light gray, wet, subangular to subrounded, coarse sand to local fine gravel up to ~¾″ (alluvium)	bit chattering @~14′		
18 19 20	bag sample @ 18′	SP	Gravelly Sand; gray, wet, subangular to subrounded, medium to coarse sand and local fine gravel up to ~¾″ (alluvium)	bottom of casing at ~18′	native backfill (caved hole)	

LOGGED BY: JLN **DATE DRILLED** 8/4/03-8/5/03 **BORING DIA.** ~8.5″ **DRILL HOLE NO.** OW-1

Depth, ft.	Sample No.	Unified Soil Symbol	SOIL DESCRIPTION	MISC. NOTES	Well Annular Space Materials	Well Casing
		SP	Gravelly Sand; gray, wet, subangular to subrounded, medium to coarse sand and local fine gravel (alluvium)	← 8/5/03 hole caved to ~20′ after coming out of hole and placing casing	native backfill (caved hole)	
21						
22						
23						
24						
25	▨ bag sample @ 25′			← finished drilling 25′@ 4:30 PM 8/4/03; left site @4:40 PM resumed drilling 8:15 AM 8/5/03		
26						
27						
28						
29						
30						

August 2003

DRILL HOLE LOG
Anderson Dam Open Well
Santa Clara County, California

LOGGED BY: JLN **DATE DRILLED** 8/4/03-8/5/03 **BORING DIA.** ~8.5″ **DRILL HOLE NO.** OW-1

Depth, ft.	Sample No.	Unified Soil Symbol	SOIL DESCRIPTION	MISC. NOTES	Well Annular Space Materials	Well Casing
		SP	Gravelly Sand; gray, wet, subangular to subrounded, medium to coarse sand and local fine gravel (alluvium)		native backfill (caved hole)	
31				slightly harder drilling between ~31-32′		
32						
33						
34						
35						
36						
37						
38						
39						
40						

August 2003

DRILL HOLE LOG
Anderson Dam Open Well
Santa Clara County, California

LOGGED BY: JLN **DATE DRILLED** 8/4/03-8/5/03 **BORING DIA.** ~8.5″ **DRILL HOLE NO.** OW-1

Depth, ft.	Sample No.	Unified Soil Symbol	SOIL DESCRIPTION	MISC. NOTES	Well Annular Space Materials	Well Casing
		SP	Gravelly Sand; gray, wet, subangular to subrounded, medium to coarse sand and local fine gravel (alluvium)			
41						
42						
43						
44						
45					native backfill (caved hole)	
46						
47						
48						
49						
50						
51	bag sample @ 52′		Bottom of boring @ ~52′ (9:00 AM-8/5/03) no bedrock encountered			
52	▭					

August 2003	**DRILL HOLE LOG** **Anderson Dam Open Well** **Santa Clara County, California**	**Page 5 of 5**

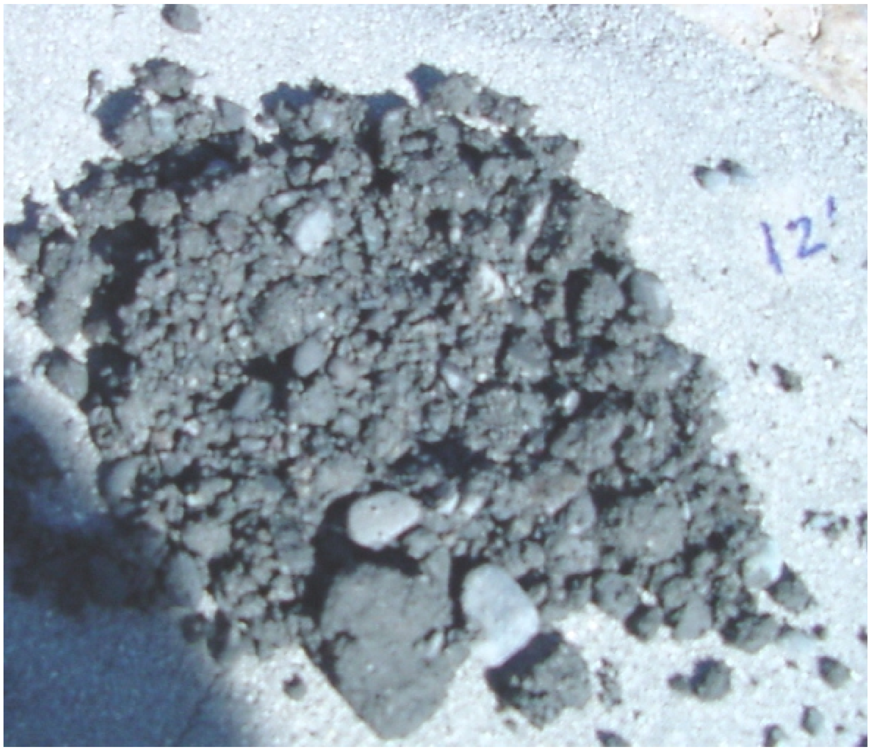


Photo No. 1 Soil Cuttings from 12', Gravelly Sand to Sandy Gravel (GP-SP),
Well rounded, medium coarse sand and fine gravel up to ¾", Alluvium

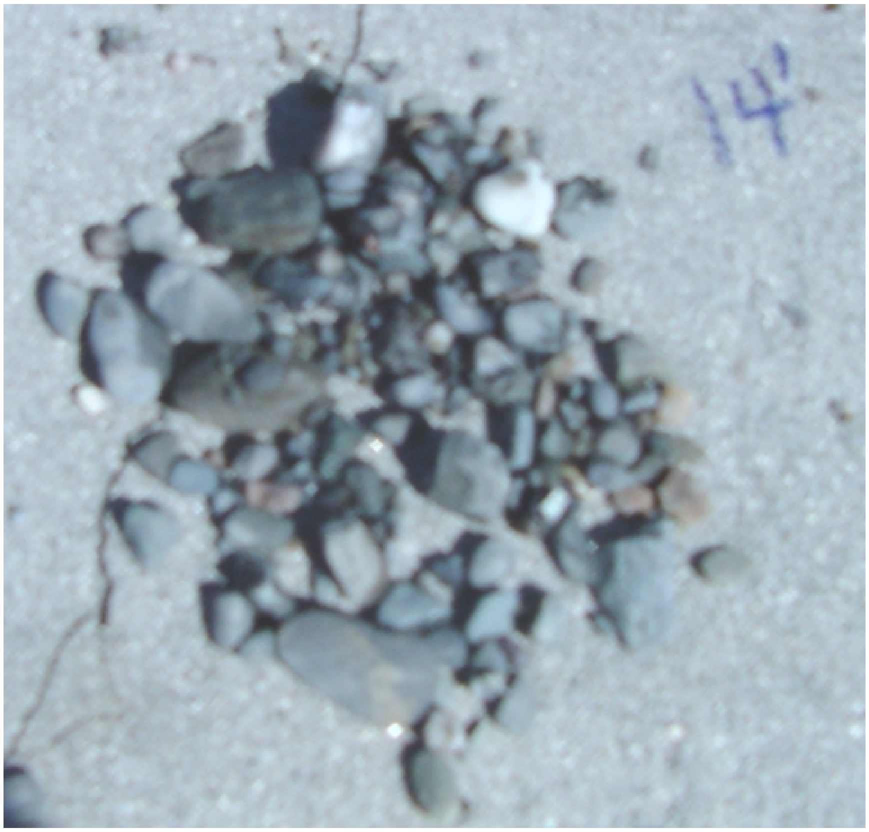


Photo No. 2 Soil Cuttings from 14', Sandy Gravel (GP),
Subangular to subrounded, coarse sand fine gravel up to ¾", Alluvium

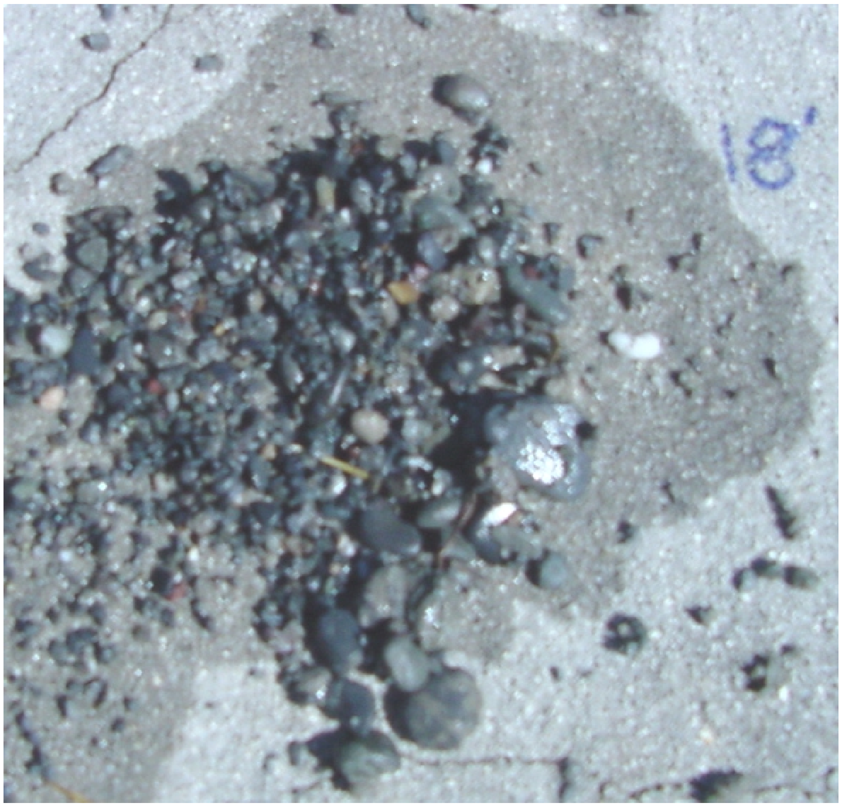


Photo No. 3 Soil Cuttings from 18', Gravelly Sand (SP),
Subangular to subrounded, medium to coarse sand and fine gravel up to ¾", Alluvium

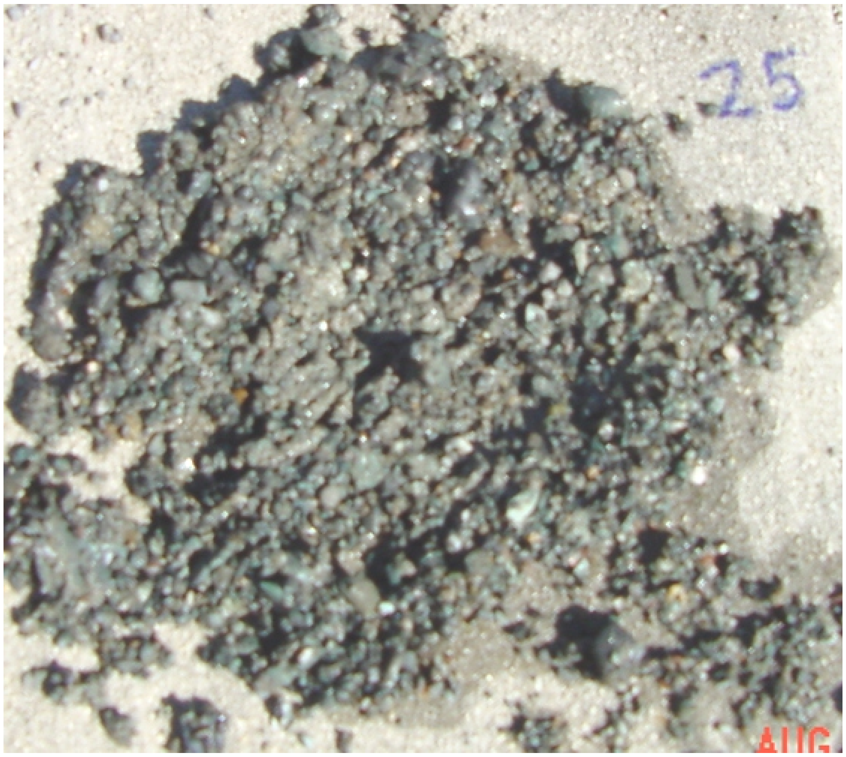


Photo No. 4 Soil Cuttings from 25', Gravelly Sand (SP),
Subangular to subrounded, medium to coarse sand and fine gravel up to ¾", Alluvium

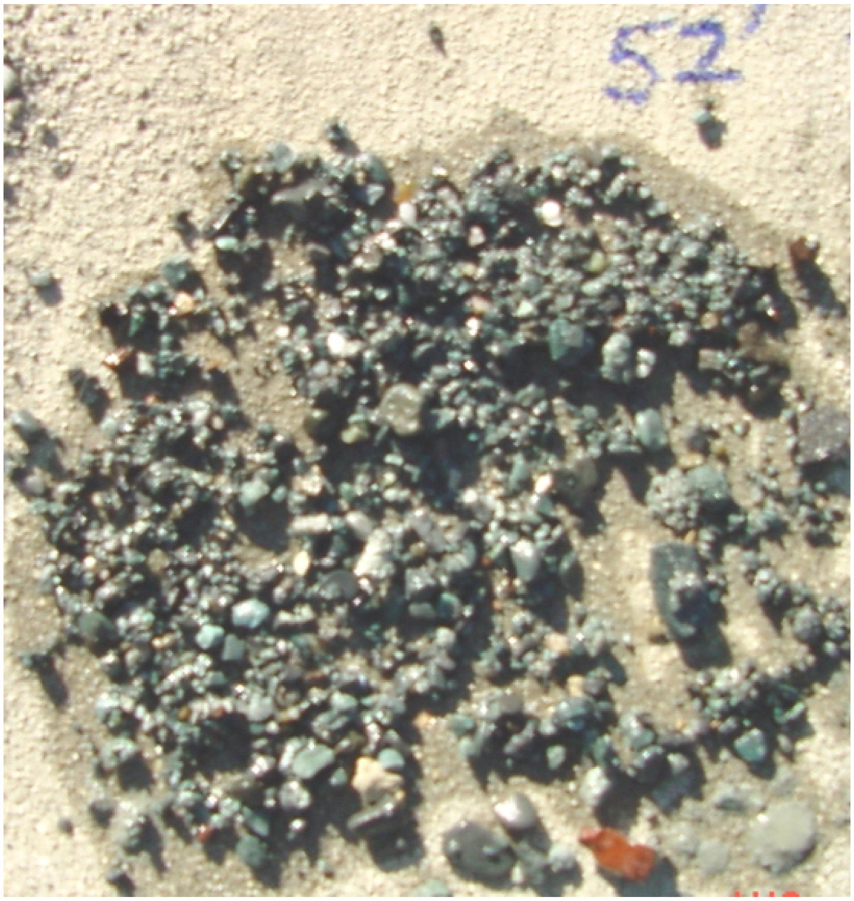
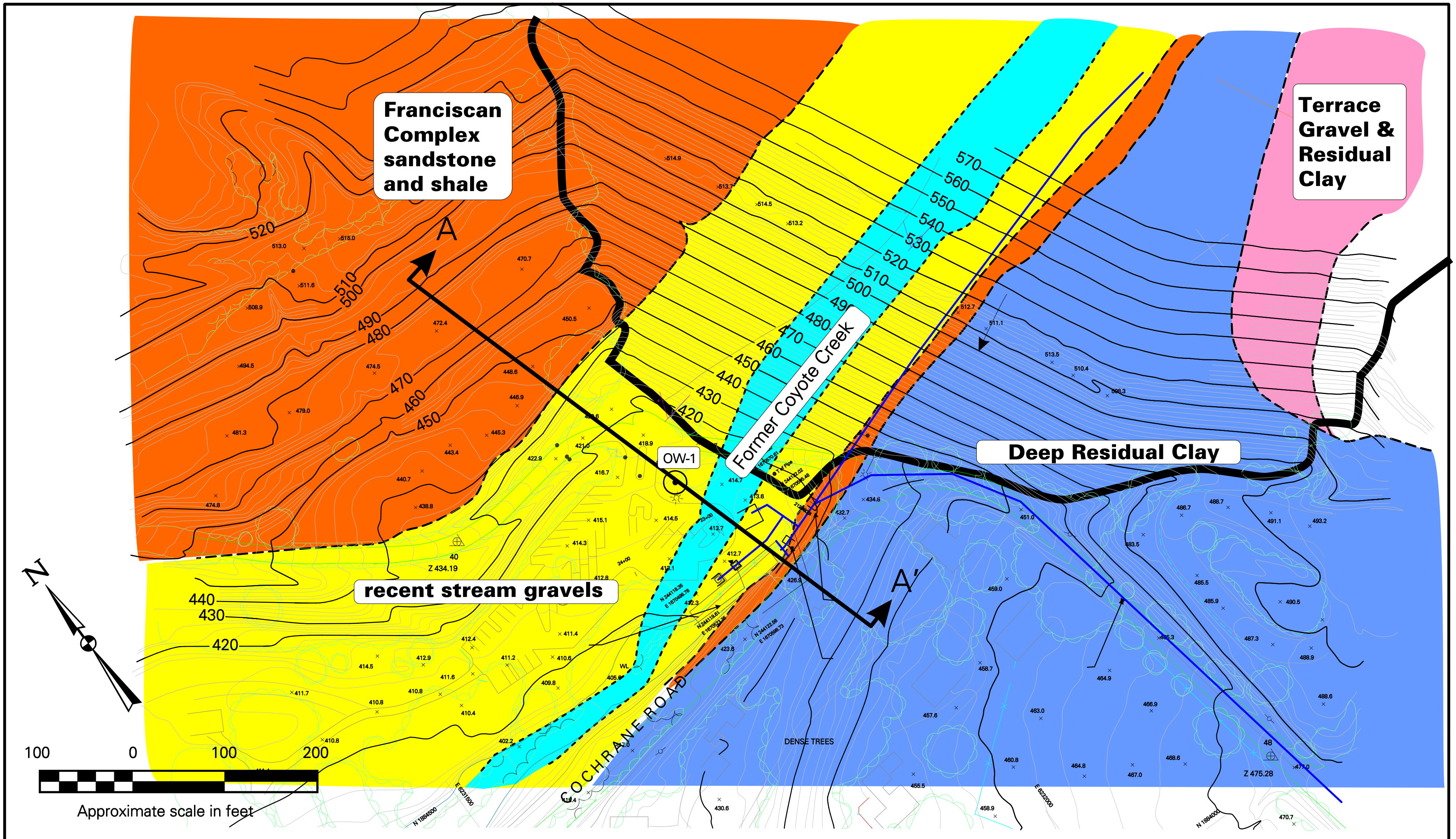


Photo No. 5 Soil Cuttings from 52', Gravelly Sand (SP),
Subangular to subrounded, medium to coarse sand and fine gravel up to ¾”, Alluvium



Geology based on undated (pre 1952) untitled map by C. Marliave

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DATE	8/7/03
DESIGN	JLN
DRAWN	JLN
CHECKED	RLV

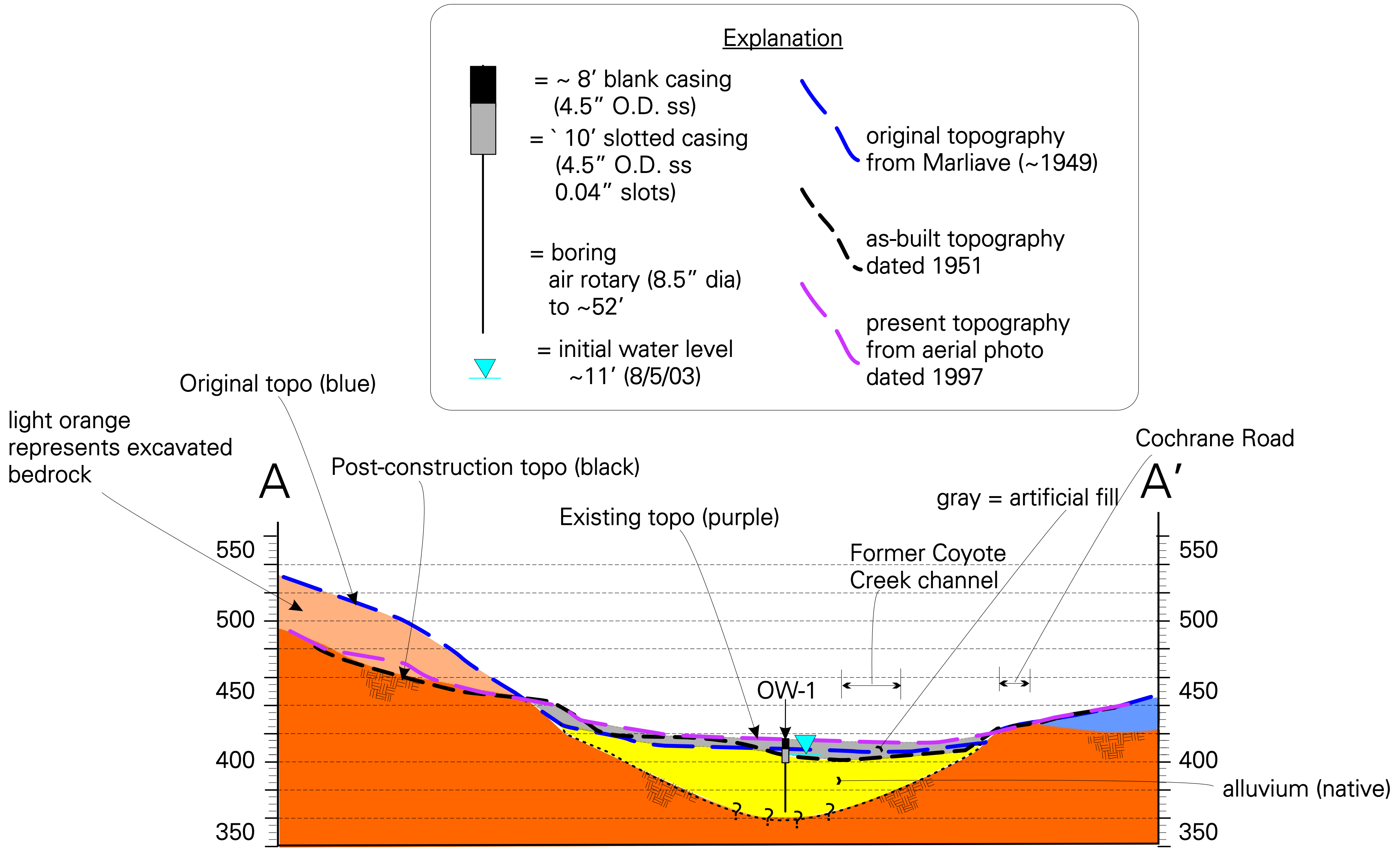
Santa Clara Valley Water District

OW-1 Location and
Pre-Construction
General Surface Geologic Map

Anderson Dam

SCALE
1" = 100'

FIGURE
1



Explanation
= ~ 8′ blank casing (4.5″ O.D. ss)
= ` 10′ slotted casing (4.5″ O.D. ss 0.04″ slots)
= boring air rotary (8.5″ dia) to ~52′
= initial water level ~11′ (8/5/03)
original topography from Marliave (~1949)
as-built topography dated 1951
present topography from aerial photo dated 1997
Original topo (blue)
light orange represents excavated bedrock
Post-construction topo (black)
Existing topo (purple)
gray = artificial fill
Cochrane Road
Former Coyote Creek channel
OW-1
alluvium (native)
A
A′
550
500
450
400
350
?
550
500
450
400
350

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Santa Clara Valley Water District

DATE 8/7/03
DESIGN JLN
DRAWN JLN
CHECKED RLV

OW-1 Section and
Pre-Construction
General Surface Geology
Anderson Dam

SCALE 1″= 100′
FIGURE 2

Appendix B

Central California Earthquake, December 22, 2003 memorandum from R. L. Volpe to D. Hook.

Santa Clara Valley Water District

MEMORANDUM

TO: Dave Hook, P.E.
Unit Manager

FROM: Richard L. Volpe, G.E.
Senior Engineer

SUBJECT: Central California Earthquake

DATE: December 22, 2003

Late this morning (11:15 and 56 seconds), Central California experienced a M_w 6.5 earthquake. The epicenter was located 7 miles northeast of San Simeon. This is within the Northern California Seismic Network, operated by the U.S. Geological Survey out of Menlo Park. USGS reports that the aftershocks are indicating a unilateral fault rupture to the southeast, with a fault length of possibly up to 15 or 20 miles. The Oceanic fault (which is actually on land, not offshore) is at the moment considered a likely culprit. It is one of a series of thrust faults located between strike-slip faults, themselves parallel to the San Andreas fault, which is about 35 miles to the northeast.

Today's earthquake was clearly felt as far away as the Bay area and Orange County, with a few reports from south of Oceanside. The town of Lockwood reported intensity Modified Mercalli VIII. Paso Robles & Shandon have reported intensity VII. These levels of shaking can easily cause damage to older structures. The AP is reporting 2 deaths in Paso Robles.

As of 3:30 this afternoon, there had been 30 aftershocks with magnitudes between 2.5 and 4.7, with the majority in the area of 3.5. The U.S.G.S. aftershock warning indicates a 90% chance of a M 5.0 or larger aftershock within the next week. The chances of a bigger quake are, of course, much smaller. The usual chance that any quake in California is a foreshock is 5% or 1 out of 20. Since it has been a little more than three hours since the mainshock and no larger quake has happened, this risk is probably now down in the 2 to 3% level. A map showing the location of the earthquake is presented in Fig. 1. Several media reports are presented following Fig. 1.

District Facilities

Using dam safety criteria of an M 5 or greater within 20 mile radius, or a peak ground acceleration greater than 0.05 g, no post-earthquake inspections were warranted for any of the District dams. Using the reported epicenter for the earthquake, the following distances and estimated peak ground acceleration at several District facilities were computed.

Facility	Latitude	Longitude	Distance from Epicenter, mi	Estimated Peak Bedrock Acceleration, g
Epicenter	35.706	121.101		
Anderson Dam	37.1667	121.6283	114.9	0.020
Uvas Dam	37.0655	121.690	99.5	0.021
CFO (Calaveras Fault Crossing)	36.9728	121.4618	89.9	0.024

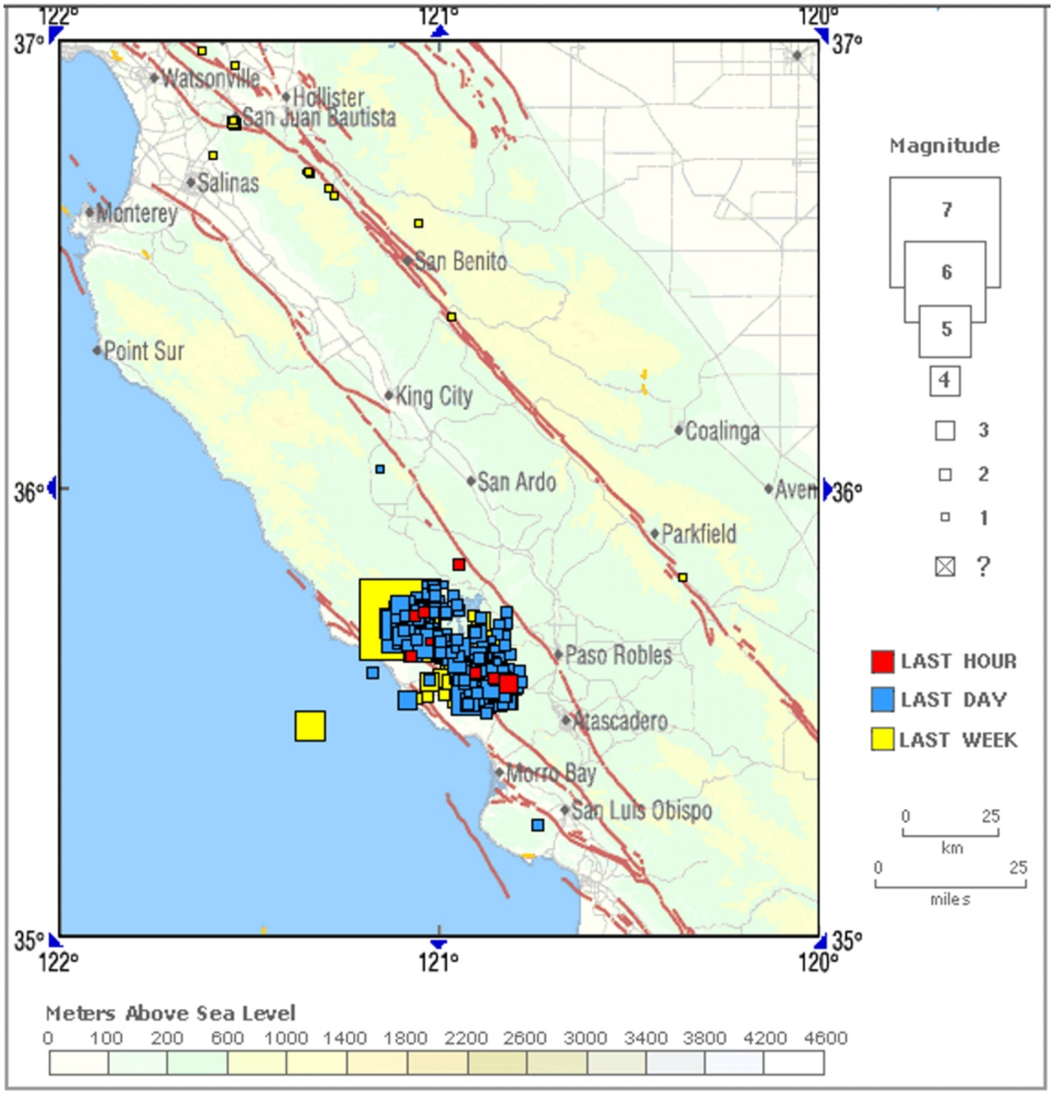

Figure 1. Main Shock and Aftershocks, December 22, 2003, M_W 6.5 EQ
(USGS web site)

Media Reports

CAMBRIA, Calif. - An earthquake rocked the central coast of California Monday, killing at least one person, knocking out power and causing widespread but mostly minor damage near the epicenter.

KSBY-TV, NBC's affiliate in San Luis Obispo, reported that one person had died in Paso Robles, a city of 25,000 about 25 miles east-southeast of the epicenter. It was believed that the victim was inside a building that partially collapsed in the downtown business district. Kelly Van Buren, a spokeswoman for the San Luis Obispo Red Cross, said two houses also were reportedly rendered inhabitable by the quake. The quake, which hit around 11:16 a.m. PT (2:16 ET) was felt as far away as Los Angeles to the south, the Central Valley in the east and San Francisco to the north. It was felt as a sustained but gentle rolling motion in downtown Los Angeles. In San Francisco, it rocked the 20-story federal courthouse, with its upper floors swaying for about 30 seconds. But people nearer the epicenter said they experienced a serious of jolts. "It was pretty sharp," said Sharyn Conn, a receptionist at the oceanside Cypress Cove Inn in Cambria. "It really went on and on. I just got everyone under the door frames and rode it out."

The U.S. Geological Survey gave it a preliminary magnitude of 6.5 and said it was centered 10 miles north of the coastal town of Cambria. Cambria is in San Luis Obispo County, about 185 miles northwest of Los Angeles. The county has a population of around 250,000.

Capable of causing severe damage A magnitude 6 quake can cause severe damage in a populated area, though damage is often much less in places with strong building codes. The epicenter is near San Simeon, William Randolph Hearst's castle. The popular tourist attraction was evacuated as a precaution but reported no obvious damage. Roy Stearns, a spokesman for the state Department of Parks and Recreation, said a crew was preparing to go over its 150 rooms in detail. John Nelson, a spokesman for Pacific Gas and Electric, said approximately 10,000 homes and businesses were without power in the San Luis Obispo area.

The utility reported no major damage at its Diablo Canyon nuclear power plant; it was being checked for minor damage. Another utility, Duke Energy, said there was no substantive damage at its two coastal power plants, Morro Bay and Moss Landing. The quake struck on a series of faults that run parallel to the San Andreas Fault, said Lucy Jones, scientist in charge of the U.S. Geological Survey office in Pasadena. "It's luckily on the coast -- there is not very much nearby. That's a good thing," Jones said Brian Lassige, a USGS spokesman, said the quake was relatively shallow, centered 4.7 miles beneath the ground, making it capable of inflicting greater damage than a deeper temblor. The USGS recorded at least 30 aftershocks in the first hour after the quake, the largest magnitude 4.7. The last earthquake of a similar size in the area occurred in 1952, said Ross Stein of the USGS in Menlo Park.

Damage, minor injuries reported The collapsed building in downtown Paso Robles was the most substantial damage reported in San Luis Obispo County, said fire department spokesman Gilbert Portillo. "Everything else seems to be little things, like medical aid and some gas leaking," Portillo added. "It's the usual stuff, broken glass and stuff. Haven't heard anything serious," agreed sheriff's Sgt. Pete Hodgkin. "Some people are hurt at the Wildhorse Winery, some wine barrels fell over. I don't know anything more. "Minor injuries also were reported as the result of a structure failure in the town of Templeton, east of San Simeon on Highway 1, said Lt. Steve Bolts, a spokesman for the county. Several fires were burning near the epicenter, possibly caused by ruptured gas mains, and a rockslide on was reported to have blocked a highway.

Damage also was reported to the Twin Cities Community Hospital in Templeton, though the facility remained open.